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Assessment of the 4TVn (Jan. - Apr.) Cod Stock for 1987

by

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ABSTRACT

The provisional catch estimate of cod in NAFO Division 4T and Sub-division 4Vn (Jan.-Apr.) in 1986 is 63,441 t. The proportion taken by Danish and Scottish seiners increased from approximately 20% of the total in 1984 and 1985 to 28% in 1986. The increase was concentrated in the second quarter. Landings of approximately 10,000 t in 1986 for the fixed gears component were the lowest in the period 1983-1986. Ageing discrepancies observed in the previous assessment were resolved and the revised age information was used in this assessment. The 1979, 1980, and 1981 year-classes were the most prevalent in the catch representing respectively 14.5, 41.1, and 17.6% of the total numbers. The standardized otter trawl catch rate for 1986 is comparable to the 3 previous years. Mean numbers per tow at age 5+ estimated from the research vessel surveys are the largest in 1985 and 1986 for the period 1971-1976. Mean catches per tow of 0-group were also the largest in 1985 and 1986, and catches of age 2 and 3 were above average in 1986. Full recruitment to the fishery is attained at age 9. Results of a 'SURVIVOR' analysis for the period 1971-1986 indicated that the discontinuity between RV and SPA noted in the previous assessment was still apparent. Calibration of SPA with standardized otter trawl catch rates and research vessel mean numbers per tow for ages 5+ indicated an Ft of 0.4 for 1986. Results of the SPA indicate that the stock biomass has attained its highest level in 1986. The 1980, 1981, and 1983 year-classes are the largest since 1971. Assuming that the 1987 TAC of 45,200 t is caught, the 1986 catch at Fo.1 would be 48,915 t.

RESUME

Les prises nominales provisoires de morue dans la Division 4T et la Sous-Division 4Vn (Jan.-Avr.) de l'OPANO en 1986 sont de 63,441 t. Le pourcentage des prises des sennes danoises et écossaises est passé de 20% en 1984 et 1985 à 28% en 1986. L'augmentation a eu lieu surtout au deuxième trimestre. Les prises des engins fixes d'environ 10,000 t sont les plus basses dans la période 1983-1986. Les divergences dans la détermination de l'âge notées dans l'évaluation antérieure ont été résolues et les données revisées sont utilisées ici. Les classes d'âge de 1979, 1980, et 1981 sont dominantes dans les captures représentant respectivement 14.5, 41.1, et 17.6% des poissons capturés. Le taux de capture standardisé des chalutiers pour 1986 est comparable aux 3 années précédentes. Les nombres moyens capturés par trait lors des relevés de navire de recherche pour les âges 5+ ainsi que pour la classe d'âge 0 sont les plus élevés en 1985 et 1986. Les captures des classes d'âge 2 et 3 sont au-dessus de la moyenne en 1986. Les individus sont pleinement recrutés a l'âge de 9 ans. Les résultats d'une analyse 'SURVIVOR' pour la période 1971-1986 démontrent que la discontinuité observée précédemment entre les relevés et l'ASP aux environs de 1979 est toujours présente. Les calibrations de l'ASP avec les taux de captures des chalutiers standardisés et les nombres moyens par trait des relevés (5+) ont donné lieu a un Ft de 0.4 pour 1986. Les résultats de l'ASP indiquent que la biomasse du stock a atteint son plus haut niveau en 1986. Les classes d'âge de 1980, 1981 et 1983 sont les plus élevées depuis 1971. Si le TPA de 45,200 t pour 1987 est capturé alors la prise au niveau Fo.1 pour 1988 sera de 48,915 t.

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INTRODUCTION

Since 1950, nominal catches taken from the 4TVn (Jan.-Apr.) cod stock have varied from a high of over 104,000 t in 1956 to a low of 22,000 t in 1977 (Table 1). Catch increased to 37,892 t in 1978, 55,996 in 1979 and has remained near 60,000 since 1980.

The migration of this stock from Division 4T to Subdivision 4Vn in the fall and its return to 4T in the spring is well known. The exploitation of the stock by the mobile fleet is centered around the migration route. In addition to mobile gears in 4Vn (Jan.-Apr.) and in 4T, the stock is exploited by fixed gears including gillnets, longlines, and handlines mostly in inshore areas.

The cod stock in the southern Gulf of St. Lawrence is the most important groundfish resource in the area. In 1986, the landed value per kg of cod increased considerably after having remained stable for the previous 5 years. Due to increased value and decreased allocations in recent years, the management regime (Table 2) has become progressively more complex to respond to the demands of the various sectors of the industry.

A) Nominal Catches and Description of the Fishery

Nominal catch for 1986 was calculated using the provisional data supplied by the Statistics Branches of the Scotia-Fundy, Newfoundland, Quebec, and Gulf regions of the Department of Fisheries and Oceans. Landings data for the French fleet fishing in 4Vn were obtained from quota monitoring personnel of the Department. The provisional estimate for 1986 is 63,441 t, almost the same as in 1985, and 6% higher than the established TAC (Table 1). Breakdowns of nominal catches by month, gear, and country are presented in Table 3 and 4. As in previous years, the winter fishery in 4Vn represented approximately one quarter of the total landings on this stock. These landings can be attributed almost exclusively to trawlers (Table 4).

In the summer fishery, the proportion taken by Quebec decreased from 37% of the total catch in 1985 to 30% in 1986, a level comparable to 1983 and 1984. The proportion taken by Danish and Scottish seines increased from approximately 20% of the total catch in 1984 and 1985 to 28% in 1986 (Table 5). The increase was concentrated in the second quarter where the seiner catch was twice the corresponding catch in the two previous years. Landings by fixed gear decreased again in 1986 to a level of approximately 10,000 t, the lowest in the period 1983-1986.

In 1986, the mobile fleet fishery in 4T was closed in three instances when allocations were reached. In this fishery allocations were usually only reached in the late fall, however the first allocation was reached July 20 (Table 2). The remaining two allocations were also reached quickly.

A high proportion of the 1986 landings (20%) were of fish less than 43 cm (commercial size). In the spring of 1987, the fishery was closed on three occasions in an attempt to alleviate the problem.

The 1987 TAC was reduced to 45,200 t from 60,000 t in 1986. The French allocation was reduced from 7,000 t to 1,200 t and Canadian allocations were reduced in approximately equal proportions. Preliminary information for 1987 indicated landings of 44,552 as of September 2, 1987, including 1,203 t reported for France in 4Vn (Jan.-Apr.). Several closures were imposed due to allocations being reached early. The pace of the mobile gear fishery for 1987 as illustrated in Figure 1, was comparable to that of 1986 for the spring fishery. The effects of the fishery closures in 1987 can be seen by the periods of no catch. The 1987 fixed gear fishery proceeded at a rate between that of 1985 and 1986.

Final statistics from NAFO for 1984 are 3,996 t lower than previously reported and are presented for reference purposes in Appendices I and II along with the revised 1985 statistics in Appendices III and IV.

B) Information Relevant to the Assessment

i) Re-ageing of Cod Otoliths

A sub-sample of the 1982 to 1985 research survey otoliths and the 1983 to 1985 commercial otoliths were re-examined because of discrepancies in the age determination observed in the previous assessment (Chouinard and Nielsen, 1986). These new readings were used in the recalculation of catch and weight at age and research vessel survey estimates for these years. Further details are provided in Chouinard et al., 1987.

ii) Research Vessel Survey

In 1986, the research vessel E.E. Prince was replaced by the Lady Hammond to conduct the annual fall groundfish survey in the southern Gulf of St. Lawrence. A comparative fishing experiment between the two vessels had been conducted in the 1985 survey to determine conversion factors. Results indicated no significant difference in fishing power for cod between the two vessels (G.A. Nielsen, Dept. of Fisheries & Oceans, P.O. Box 5030 Moncton, N.B., pers. comm.).

In addition to the change of survey vessels, several changes were made to the survey design in 1984. Most importantly, the random-stratified station design was replaced by a fixed station survey with non-random initial allocation of stations. Investigation of this change using the 1984 and 1985 surveys did not indicate that the non-random station allocation had resulted in a scaling factor different from one between the two survey types. To maintain the possible bias constant, the index for 1984 onward was calculated from a constant set of stations.

The Lady Hammond fished 24 hours a day but only the data from the day stations were used for the 1986 population estimates. A constant trawlable unit size was used for both vessels.

INPUT DATA

A) Commercial Fishery Data

i) Catch and Weight at Age

In 1986, sampling of the commercial fishery was comparable to the previous years. All gear and quarter components were sampled with close to 64,000 fish measured (Table 6). Random stratified (on length) sub-samples of the otoliths collected were selected to construct quarterly age-length keys containing a minimum of 400 otoliths. The length frequencies by gear and quarter weighted by the corresponding landings were used with the appropriate age-length key to obtain the catch at age by gear and quarter. Unsampled landings were calculated by multiplying the catch at age for sampled gears by the ratio of unsampled to sampled landings.

Catch at age by gear and quarter is presented in Table 7. The catch of the 1980 year-class (age 6) in the second quarter in otter trawls and seines accounts for half of the numbers of this year-class in the total catch at age. The fishery in 1986 was unusual by the large proportion of the catch taken in the second quarter (44% by weight) compared to the previous years (29-32%). In addition, the 1980 year-class constituted 50% of the otter trawl and seine catch numbers while it made up only 36% in the other quarters. It appears that the fishery in the second quarter was highly directed towards the 1980 year-class.

Weights at age were calculated using a length-weight relationship calculated from 1986 research survey data. The parameters of the power curve ($Y = ax^b$) were a = 0.0073503 and b = 3.062213 with a correlation coefficient of 0.99. The weights at age by gear and quarter (Table 8) generally exhibit lower values for mobile gears than for the fixed gears.

Catch at age for the years 1971-1986 is presented in Table 9 with the corresponding average weight at age in Table 10. The 1980 year-class which appeared in high numbers in 1985 at age 5 accounts for 41% of numbers caught in 1986. The 1979 year-class does not appear in high numbers in 1986 compared to 1985. Weights at age for 1986 are comparable to values obtained in recent years.

Although catch at age for 1987 is not available, examination of the length frequencies from the otter trawl and seine catches in the first and the second quarters (Figures 2, 3, and 4) from 1984 to 1987 indicate a gradual reduction in the modal length of the catch. The modal length in the first quarter of 1987 (Figure 2) was 43 cm, compared to 52,49 and 46 in 1984, 1985 and 1986 respectively.

ii) Commercial Catch Rates

Separate catch rate indices were calculated for otter trawls and seines due to differences in partial recruitment to the two gears and uncertainties about how the effort is recorded for seiners. Together, these two gears represented over 85% of the available catch rate data. The years 1966-86 were used. The 1984-85 data were revised according to the 1984 NAFO

statistics and 1985 regional data respectively. Observations with less than 10 unit of catch or effort were removed. A multiplicative model was used to calculate a standardized catch rate index for each gear (Gavaris, 1980).

For otter trawls, observations were allocated to categories of gear/tonnage class (TC)/NAFO division, month, and year. Gears with less than 10 observations for the time series were eliminated from further analysis. An initial analysis indicated that observations with low values of effort generally had higher residuals. A series of weights were estimated from the mean squared residuals from two segments of the observations separated on the basis of effort. A subsequent analysis indicated an improvement in the residual distribution. Examination of the residuals from 1984 by region indicated that over 75% of those from Quebec were negative while most of the other observations were positive. We discovered later that corrections made to the Quebec fleet catch and effort data did not appear in the NAFO Statistical Bulletin. Thus, the 1984 Quebec data were eliminated from further analyses.

The analysis of variance from the final run is given in Table 11. The model accounted for 77% of the variation and each category was significant. The regression coefficients are given in Table 12. It is interesting to note the similarities in coefficients for TC 4 and 5 otter trawls for region 2, Can (M-Q) and 27, Can (M). This may be because the same vessels are involved. However, for the TC 2 and 3 vessels the coefficients for Can (M) are higher, possibly indicating an increase in fishing power for these vessels in the recent past.

The 1984 catch rate is similar to that of 1983 and 1985-86 (Table 12, Figure 5). The overall trend is for decreasing catch rates from 1968-74 followed by increases to 1983. Since 1983, catch rates are relatively stable.

The data for seiners came almost exclusively from Can (M) vessels. An initial analysis indicated that the Division category was not significant. The residual distribution did not indicate heteroscedasticity, consequently weighting was not used. In the final analysis, the model accounted for 58% of the variance and the gear, month, and year categories were significant (Table 13).

The coefficient estimates and the catch rate series are given in Tables 13 and 14 respectively. No observations were available for 1974-75. Between 1966-1973, catch rates were variable with no apparent trend. Following that, there was an increase to 1981, stability to 1983, then a decline in 1984 and 1985. The 1986 value was higher than the previous two years, but not as high as the 1980-83. This is in contrast to the otter trawl series that showed an increase through the 1976-86 period. The seiner catch has increased greatly in the post-1976 (Table 5) period indicating that new vessels entered the fishery. The catch rates before and after that time may not be directly comparable. Furthermore, the effort reported by seiners may not reflect actual fishing time as it has been observed that handling time is sometimes included in fishing time in logs. Based on this, the seiner catch rate series was not used for calibrations.

B) Research Survey Data

Mean numbers per tow at age 5+ estimated from the research vessel (RV) surveys are the largest observed in the series in 1985 and 1986 (Table 15). The large numbers of fish observed in the 1985 survey are due to one catch of 4,873 kg in stratum 24 (Figure 6). The Lady Hammond which was fishing closeby as part of the comparative fishing experiment obtained a catch of 4,890 kg on the same station. In 1986, the large estimate is also partly due to a large catch in one set (1,104 kg). Mean numbers per tow at age indicates that the 1979 and 1980 year-classes were of similar strength. The 1981 year-class also appears to be above-average. The mean catches per tow of 0-group in 1985 and 1986 were the highest observed. The catches of age 2 and 3 year-olds in 1986 were above average indicating that the 1984 and 1985 year-classes might be large.

ESTIMATION OF PARAMETERS

A) Survivor Analysis

In the previous assessment of this stock (Chouinard and Nielsen, 1986), it was noted that the constant of proportionality (k) from the Survivor Analysis (Doubleday, 1981) was lower in the 1980's than in the 1970's, which made the analysis unreliable. Although a documented change in diet was postulated as a cause, this could not be verified.

With the revised ageing information, the Survivor method was again used to analyze the 1971-86 research vessel and commercial data. The previously noted discontinuity between RV and SPA at about 1979 was still apparent. Residual plots from an analysis conducted using a calibration block of 1971-84 and age 8 with full recruitment at age 6 indicated that the basic model of Survivor ($N = kA$) may not be appropriate for the observed range of population sizes (Figure 7). Examination of age by age plots of RV versus SPA estimates for age 3-5 does not indicate as abrupt a change in catchability. One possible explanation may be that the relationship is not linear. Further work is needed to explain how such a relationship could exist given the survey design.

As was done in the previous assessment, the Survivor analysis was used on the data since 1979. However, examination of calibration plots for this shorter time series also indicated a pattern in the residuals. Consequently, these results were not used.

B) Partial Recruitment (PR)

In the past 3 years, comparisons of commercial fishery and research survey catches were used to estimate partial recruitment because no consistent trends in PR were apparent in the matricies of fishing mortality (F). With the recent corrections to ageing data, PR estimates from the F matricies were considered to be more reliable.

Analysis of fishing mortalities for the 1983-85 period was done on an iterative basis with new PR estimates being used in successive calculations until stability was reached. Full recruitment was assumed at age 10 and PR was calculated as the ratio of F to weighted mean fully recruited F. The analysis indicated that PR has been increasing in the recent past. The resulting vector indicated full recruitment at age 9 and is presented below:

Age	3	4	5	6	7	8	9	10	...
PR	.004	.021	.170	.578	.777	.833	1.000	1.000	...

C) Sequential Population Analysis

Calibration between 4+ fishable biomass and commercial catch rates have been used for this stock, but in recent assessments these attempts have failed to give conclusive results. Corrections to ageing data and the use of the more reliable otter trawler catch rate series has improved these relationships. Calibration with otter trawl catch rates used otter trawl fishable biomass. The otter trawl fishable biomass was calculated as otter trawl PR multiplied by mean biomass. PR for this gear was determined from tables of partial F, assuming that the otter trawl catch was evenly distributed throughout the year. Examination of the partial F table indicated full recruitment at ages 6-7 from 1971 to 1979 and following that at ages 8-10. To estimate yearly PR, catch weighted mean F for the fully recruited ages was calculated and divided into age by age values in the respective years. Values greater than 1 were set to 1 and for the ages assumed to be fully recruited a PR of 1 was assigned. Otter trawl partial recruitment at an F of 0.4 is presented in Table 16.

Cohort analyses were performed over a range of F from 0.2 to 0.45. The highest correlation coefficient was found at F = .25 but the intercept was negative and the 1985 and 1986 residuals were relatively high (Table 17). The F that minimized the intercept was at .375, and this put the last two data points closer to the line. The sum of the squares of the last 5 standardized (MSE) residuals declined with increasing F. Given these divergent indications, the simpler model with a 0 intercept was chosen and this indicated a terminal F of .375. The calibration plot is given in Figure 8.

Research vessel survey 4+, 5+, and 6+ numbers per tow were compared to SPA mean numbers. Regressions with age 4+ data were not significant. For ages 6+ the relationships were significant but the residuals for the last 2 years were large and of opposite sign. For ages 5+, the regressions were considered to be adequate for calibration purposes. These relationships had high positive intercepts. For the range of population sizes from 1979-86, a linear relationship with such an intercept can be accepted since there are no observations close to zero on either axis. Given this and the short time series, the calibration criterion was solely the correlation coefficient. The highest value was .902 at Ft of .425 (Table 18, Figure 9).

Based on these results and the calibration with otter trawl catch rates, an Ft of .40 was accepted.

Age 3 and 4 population estimates in 1986 from cohort analysis with Ft of .40 and the PR given above were well above the range of values previously observed. However, the mean PR estimates for these ages were considered unreliable due to the low catch at age. Instead, RV and mid-year SPA estimates at ages 3 and 4 were compared using linear regression. The correlations coefficients were .71 and .78 for the age 4 and 3 regressions respectively, and the linear regressions had non-significant intercepts; but observations close to the intercept had predominantly negative residuals. (Table 19, Figure 10). Non-linear models gave higher correlation coefficients (0.89 and 0.83 for ages 4 and 3) and minor improvements in residual distribution. However, the underlying basis of these models could not be explained. Thus the linear regressions were used to predict age 3 and 4 abundance in 1986. These gave beginning of the year numbers of 177 million and 135 million respectively (Table 20).

Using the implied PR at age 3 (0.002) and 4 (0.070), the resulting population numbers, biomass and fishing mortalities are presented in Tables 20, 21, and 22.

ASSESSMENT RESULTS

A) Recruitment

The geometric mean recruitment (age 3 numbers) from the 1968-1981 year-classes is 90 million fish. The 1979-1983 year-classes are all estimated to be well above the mean (Figure 11); and the 1980, 1981, and 1983 year-classes are the largest since 1970. This is consistent with the increased landings of small cod in the southern Gulf of St. Lawrence.

B) Stock Size and Production

The 3+ biomass of the stock declined in the early 1970's to a minimum in 1975 (Figure 12). This corresponds to a period of relatively poor recruitment and high fishing mortality (Figure 13). With the reduction of fishing mortality in 1977-78 and the recruitment of the large 1974 and 1975 year-classes, biomass increased rapidly to 1979. After a period of relative stability in the early 1980's, the stock biomass has again increased; and the estimated 1986 level is the highest in the time series.

Stock production is summarized in Figure 14. Total production is given as the sum of growth of fish already in the population and the beginning of the year biomass of age 3 recruits. The growth component increased from 1970 to 1978, declined to 1982, and increased again to the present. This trend corresponds with the observed increase in mean weights at age through the mid-1970's, the decrease in the early 1980's, and the recent stability in weights with increasing abundance. Recruitment biomass was low in the early

1970's, it increased with the appearance of the 1974-75 year-classes, and has remained relatively constant since. The 1980-83 year-classes, which are large in numbers, have relatively low weights at age.

Surplus production is compared to catch in Figure 14. Surplus production is the total production less the loss in biomass due to natural mortality. When catch exceeds surplus production, biomass in that time period declines. This condition existed from 1970 to 1975. From 1976-79, surplus production was high and catches were reduced, leading to the rapid increase in biomass in that period. From 1980-83, catch and surplus production were evenly matched; and since 1984, biomass has increased.

PROGNOSIS

Catch projections to 1988 used the 1987 beginning of the year population numbers from cohort analysis, average weights at age from 1984-86, a period of stability, and PR at ages 3 and 4 implied from the RV predictions (Table 23). Age 3 recruitment in 1987-88 was set at the geometric mean of the 1968-81 year-classes of 96 million.

The results indicate that if the 1987 TAC of 45,200 t is caught, this will result in a terminal fishing mortality of .221, and a Fo.1 = .2 catch in 1988 of 48,915 t. Results are presented in Table 24. Fishing at Fo.1 in 1987 would give a catch of 41,182 t, a catch already exceeded.

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Table 1: Nominal 4TVn (Jan-Apr) cod catch and total allowable catch (TAC) for 1950 to 1987. Sources: a. 1950-1964 from Lett, 1978 b. 1965-1984 from NAFO statistics; c. 1985 and 1986 provisional from Department of Fisheries and Oceans, Statistics Branches; d. Catch as of September 2, 1987 (preliminary)

YEAR	NOMINAL CATCH (t)	TAC (t)	YEAR	NOMINAL CATCH (t)	TAC (t)
1950	44023[a]	-	69	47819	-
51	34827	-	1970	64465	-
52	41956	-	71	56375	-
53	58911	-	72	65291	-
54	63901	-	73	50635	-
1955	65227	-	74	48747	63000
56	104469	-	1975	42471	50000
57	89131	-	76	33415	30000
58	86582	-	77	22219	15000
59	70720	-	78	37892	38000
1960	66013	-	79	55996	46000
61	65583	-	1980	54634	54000
62	66664	-	81	65177	53000
63	70202	-	82	58193	60000
64	60547	-	83	61295	62000
1965	63027[b]	-	84	55364	67000
66	54851	-	1985	63047[c]	67000
67	41316	-	86	63441	60000
1968	46551	-	87	42020[d]	45200

Table 2. Resource allocation scheme for cod in Division 4T and Subdivision 4Vn (Jan.-Apr.) 1979-1987.

Year	Area	Gear/Period	Final Allocation (tonnes)	Catch (tonnes)	Closure
1979	4T	M.G.* (Jan 1-Oct 31)	16000	25168[a]	
		M.G. (Nov 1-Dec 31)	2000		
		F.G.** All	8000	15156	
	4Vn	M.G. (< 1050 BHP)***	4000	12364a	
		M.G. (> 1050 BHP)	2800		
		M.G. < 65'	300		
		France Allocation	2900	2839	
1980	4T	M.G. (Jan 1-Oct 31)	24760	22870	
		M.G. (Nov 1-Dec 31)	2000		
		F.G.	9000	12116	
	4Vn	M.G. (>65' & <1050 BHP)	4550	4491	Feb 4
		M.G. (>65' & >1050 BHP)	4550	4469	Jan 31
		M.G. < 65'	300	208	
		F.G.	300	428	
		France Allocation	8640	8895	
1981	4T	M.G. (Jan 1-Oct 31)	25000	30463a	
		M.G. (Nov 1-Dec 31)	3000		Nov 22
		F.G.	10000	17583	Nov 28
	4Vn	M.G. (>65' & <1050 BHP)	6000	5799	Jan 21
		M.G. (>65' & >1050 BHP)	1000	1314	Jan 12
		M.G. < 65'	500	317	
		F.G.	500	1305	
		France Allocation	7000	8118	
1982	4T	M.G. (Jan 1-Oct 31)	26200	26247a	
		M.G. (Nov 1-Dec 31)	3000		
		F.G. (Jan 1-Jun 30)	4000	12799a	
		F.G. (Jul 1-Dec 31)	11000		
	4Vn	M.G. > 100'	7200	6938	
		M.G. (65' - 100')	300	63	
		M.G. < 65'	400	487	
		F.G. (65' - 100')	100	----	
		F.G. < 65'	800	372	
		France Allocation	7000	6816	

Table 2. (Continued)

Year	Area	Gear/Period	Final Allocation (tonnes)	Catch (tonnes)	Closure
1983	4T	M.G. (Jan 1-Nov 9)	29937	29645	Nov 11
		M.G. (Nov 9-Dec 31)	2500	3445	Dec 9
		F.G. (Jan 1-Jun 12)	1451	1679	
		F.G. (Jun 13-Nov 9)	12555	12341	
		F.G. (Nov 10-Dec 31)	1094	993	
	4Vn	M.G. > 100'	6312	6312	
		M.G. (65' - 100')	4	4	
		M.G. < 65'	800	806	
		F.G. (65' - 100')	4	4	
		F.G. < 65'	349	394	
		France Allocation	7000	6360	
1984	4T	M.G. (Jan 1-Nov 9)	30000	23583	
		M.G. (Nov 9-Dec 31)	3000	4438	
		F.G. (Apr 1-Jun 10)	1665	2036	
		F.G. (Jun 11-Nov 4)	13335	10782	
		F.G. (Nov 5-Dec 31)	2000	1206	
	4Vn	M.G. > 100'	7800	6601	
		M.G. (65' - 100')	338	254	Jan 21
		M.G. < 65'	1260	1294	
		F.G. < 65'	602	145	
		France Allocation	7000	6470	
1985	4T	M.G. (Jan 1-Nov 9)	33048	32056	
		M.G. (Nov 10-Dec 31)	5461	5937	
		F.G. (Apr 1-Jun 10)	2000	1638	
		F.G. (Jun 11-Nov 4)	11250	8450	
		F.G. (Nov 5-Dec 31)	750	616	
	4Vn	M.G. > 100'	6680	6736	
		M.G. (65' - 100')	82	82	
		M.G. < 65'	728	728	
		F.G. < 65'	1	2	
		France Allocation	7000	6762	

Table 2. (Continued)

Year	Area	Gear/Period	Final Allocation (tonnes)	Catch (tonnes)	Closure
1986	4T	M.G. < 100' (Jan 1-Sept 7)	28158	30237	Jul 20
		M.G. < 100' (Sept 8-Nov 9)	3000	4253	Oct 13
		M.G. < 100' (Nov 10-Dec 31)	2650	3750	Nov 20
		F.G. < 65' (Apr 1-Jun 10)	1543	1475	
		F.G. < 65' (Jun 11-Nov 4)	8517	7488	
		F.G. < 65' (Nov 5-Dec 31)	440	573	
	4Vn	> 100' and < 1050 BHP	6926	6955	
		M.G. 65' - 100'	182	182	Jan 30
		F.G. < 65'	309	239	
		M.G. < 65'	1272	1515	Feb 7
		France Allocation	7000	6493	
1987b	4T	M.G. < 100' (Jan 1-Apr 14)	1200	1584	Jan 24
		Entreprise Allocation W. Nfld	800	1722	Apr 16
		M.G. < 100' (Apr 15-Jun 11)	13750	17106	May 22
		M.G. < 100' (Jun 12-Jun 27)	3000	3226	Jun 23
		M.G. < 100' (Jun 28-Jul 4)	600	930	Jun 30
		M.G. < 100' (Jul 5-Aug 5) (by-catch)	670	551	
		M.G. < 100' (Aug 6-Nov 9)	5150	4817	Aug 21
		M.G. < 100' (Nov 10-Dec 31)	1480	N/A	
		F.G. < 65' (Apr 1-Jun 10)	3200	1879	
		F.G. < 65' (Jun 11-Nov 4)	7300	4987	
		F.G. < 65' (Nov 5-Dec 31)	300	N/A	
	4Vn	All > 100'	5100	5275	
		F.G. 65' - 100'	80	----	
		M.G. 65' - 100'	85	103	Jan 24
		F.G. < 65'	245	133	Apr 17
		M.G. < 65' (Jan 1-Apr 15)	940	812	
		M.G. < 65' (Apr 16-Apr 30)	100	224	
		France Allocation	1200	1203	

a - Indicates total categories to the next number
b - Data for 1987 to September 2 (preliminary)
* - Mobile gear
** - Fixed gear
*** - Brake horsepower

Table 3 : Provisional 4T cod catches (t round weight) during 1986 by gear type and month in Maritime Provinces, Newfoundland and Quebec.

MARITIMES

GEAR	MONTH J	F	M	A	M	J	J	A	S	O	N	D	TOTAL	% OF 4TVn (Jan-Apr) CATCH
Otter trawl (side)					901	380	27	11	50	18	714		2101	3.31
Otter trawl (stern)	515		11	913	1317	489	599	122	161	149	643		4919	7.75
Shrimp trawl				4		32	7			15			58	0.09
Danish seine				4606	6022	1958	1982	46	436	372	1448	2	16872	26.59
Scottish seine				8									8	0.01
Pair seine					78	50	54	21	15	6	125		349	0.55
Gillnets (set)				20	79	128	614	421	340	115	13		1730	2.73
Drift gillnet						2							2	0.00
Set lines				23	77	16	120	197	155	142	371	13	1114	1.76
Handlines						5	26	9	12	10			62	0.10
Handlines with bait					32	70	98	81	106	32	4		423	0.67
Longlines					25	2	3	1		21	126	7	185	0.29
Uncov. pound nets					8	5		2					15	0.02
TOTAL	515		11	5574	8539	3137	3530	911	1275	880	3444	22	27838	43.88

NEWFOUNDLAND

Otter trawl (stern)	994		11		9	1					30		1045	1.65
Otter trawl (side)							2						2	0.00
TOTAL	994		11		9	1	2				30		1047	1.65

QUEBEC

Otter trawl (side)				21	2163	1832	1382	30	1062	678	239		7407	11.68
Otter trawl (stern)				142	1031	986	744	21	549	517	202		4192	6.61
Bottom pair trawl					136	44	41	30	59	32			342	0.54
Shrimp trawl				1	1	1	2	11	70	107	83		276	0.44
Danish seine					6	58	48	6	15	13	9		155	0.24
Gillnet				16	1034	366	477	350	243	141	1		2628	4.14
Longline				11	412	396	546	475	430	372	13		2655	4.18
Handline	1	1		2	79	134	360	353	243	187	17		1377	2.17
Covered pots					6	6	3						15	0.02
Unknown						1							1	0.00
TOTAL	1	1	0	193	4868	3824	3603	1276	2671	2047	564		19048	30.02
TOTAL 4T	1510	1	22	5767	13416	6962	7135	2187	3946	2927	4038	22	47933	75.56

Table 4 : Provisional 4Vn (Jan.-Apr.) cod catches (t round weight) during 1986 by gear type and month in Maritime Provinces, Newfoundland and France.

GEAR TYPE	J	F	M	A	TOTAL	% OF 4TVn (Jan-Apr) CATCH
			Maritimes			
			MONTH			
Otter trawl (side)	1090	928		442	2460	3.88
Otter trawl (stern)	1557	693	2	1169	3421	5.39
Longline	11			59	70	0.11
Scottish seine				31	31	0.05
Danish seine				179	179	0.28
TOTAL	2658	1621	2	1880	6161	9.71
			NEWFOUNDLAND			
Otter trawl (stern)	1058	1192	499	55	2804	4.42
Otter trawl (side)				50	50	0.08
TOTAL	1058	1192	499	55	2854	4.50
			FRANCE			
Otter trawl (stern)	1981	4191	321		6493	10.23
TOTAL	1981	4191	321		6493	10.23
TOTAL 4Vn	5697	7004	822	1935	15508	24.44

Table 5 : Cod catch (t) by gear in 4TVn (Jan-Apr) 1965-1986

YEAR	GEAR						
	Otter trawl	Seines	Gillnets	Longlines	Handlines	Misc.	TOTAL
1965	48371	2673	3571	3189	-	5223	63027
1966	36684	2391	9414	1302	-	5060	54851
1967	23971	2225	9942	1579	2371	1228	41316
1968	28205	994	12933	395	2883	1141	46551
1969	27048	1228	9578	3710	5020	1235	47819
1970	43059	1793	9786	5490	3191	1146	64465
1971	35463	2255	9676	3008	3985	1988	56375
1972	46462	2115	7854	995	2100	5765	65291
1973	35798	2106	8129	420	2127	2055	50635
1974	34565	1741	6070	906	1266	4199	48747
1975	28408	1972	6327	139	3527	2098	42471
1976	25170	1354	4449	55	1169	1218	33415
1977	10964	3058	5931	207	1114	945	22219
1978	22539	4474	8929	155	1342	453	37892
1979	31576	8767	12022	615	1781	1235	55996
1980	32473	9977	4260	1443	723	5758	54634
1981	33963	12327	4053	5839	1055	7940	65177
1982	30627	11273	4175	3781	872	7465	58193
1983	31979	13763	3010	3070	1270	8203	61295
1984	31593	10616	6891	3738	1862	664	55364
1985	40089	12169	5304	3209	2061	215	63047
1986	35570	17594	4360	4024	1862	31	63441

Table 6 : Number of fish sampled from the 1986 fishery for cod in 4TVn (Number measured/Number aged).

Gear	MONTH												
	J	F	M	A	M	J	J	A	S	O	N	D	Total
Otter Trawl	4539	4071	743	1755	4919	3178	2591	67	2232	1841	2106	0	28042
	310	79	23	31	72	34	30	0	14	77	63	0	733
Seines	0	0	0	925	5339	2545	1496	929	578	315	1228	0	13355
	0	0	0	3	61	63	37	9	6	50	61	0	290
Gillnets	0	0	0	0	514	889	2677	1290	759	0	0	0	6129
	0	0	0	0	17	19	51	37	29	0	0	0	153
Longlines	0	0	0	0	1105	1118	3669	2806	2646	2725	277	0	14346
	0	0	0	0	55	44	84	33	40	135	11	0	402
Handlines	0	0	0	0	0	296	951	123	0	500	0	0	1870
	0	0	0	0	0	3	28	8	0	26	0	0	65
Total	4539	4071	743	2680	11877	8026	11384	5215	6215	5381	3611	0	63742
	310	79	23	34	205	163	230	87	89	288	135	0	1643

Table 7 : Cod (4TVn) catch at age by gear and quarter in 1986.

GEAR	OTB-C	OTB-F	OTB	OTB	OTB	SNU	SNU	SNU	GNS	GNS	LLS	LLS	LLS	LHP	LHP	LHP	UNSAMPLED	
QUARTER	1	1	2	3	4	2	3	4	2	3	2	3	4	2	3	4	CATCH	TOTAL
AGE																		
2	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	2
3	1	2	4	10	66	27	10	2	0	0	0	1	0	1	3	2	0	129
4	208	261	333	294	668	1130	257	109	1	3	4	25	20	24	41	20	2	3400
5	600	584	1243	751	1044	2311	452	259	13	11	17	97	64	51	91	46	5	7639
6	2692	2196	4850	1716	1208	6273	844	513	193	87	109	284	184	155	225	79	15	21623
7	1728	1301	1843	915	229	1727	424	156	189	150	89	220	85	44	152	22	6	9280
8	980	682	411	262	141	315	137	125	103	170	57	130	72	8	85	16	3	3697
9	595	393	354	220	75	281	115	96	88	159	55	122	67	7	78	11	2	2718
10	408	276	498	97	33	410	47	49	78	95	42	63	35	11	42	5	2	2191
11	218	166	117	48	19	89	31	40	59	108	38	58	32	2	39	2	1	1067
12	255	179	35	41	4	27	23	12	14	71	10	42	11	1	26	1	1	753
13	21	18	31	2	1	25	2	3	14	18	8	8	2	1	5	0	0	159
14	0	0	5	0	0	3	0	0	3	3	2	1	0	0	0	0	0	17
15	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	3
16	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	2
TOTAL	7706	6058	9726	4357	3488	12619	2343	1364	755	875	433	1051	572	305	787	204	37	52680

Notes: Gears: OTB-C = Canadian trawlers, OTB-F = French trawlers, SNU = seiners, GNS = gillnets, LLS = longlines, LHP = handlines

Quarters: 1 = Jan.-Mar., 2 = Apr.-June, 3 = July-Sept., 4 = Oct.-Dec.

Table 8 : Cod (4TVn) weight at age (kg) by gear and quarter in 1986

GEAR	OTB-C	OTB-F	OTB	OTB	OTB	SNU	SNU	SNU	GNS	GNS	LLS	LLS	LLS	LHP	LHP	LHP	AVERAGE
QUARTER	1	1	2	3	4	2	3	4	2	3	2	3	4	2	3	4	WEIGHT
AGE																	
2	0.00	0.00	0.00	0.36	0.00	0.00	0.36	0.00	0.00	0.00	0.00	0.36	0.00	0.00	0.36	0.00	0.360
3	0.27	0.27	0.47	0.43	0.43	0.47	0.45	0.46	0.00	0.27	0.47	0.44	0.00	0.47	0.45	0.36	0.437
4	0.48	0.45	0.57	0.69	0.71	0.54	0.67	0.78	0.63	0.67	0.59	0.69	0.86	0.54	0.66	0.78	0.602
5	0.64	0.63	0.86	0.94	0.86	0.78	0.87	0.95	1.02	1.04	0.87	1.02	1.00	0.79	0.93	0.94	0.816
6	0.86	0.83	1.09	1.06	1.05	0.99	1.03	1.23	1.54	1.72	1.38	1.25	1.36	1.01	1.16	1.19	1.014
7	1.07	1.03	1.40	1.21	1.28	1.31	1.24	1.69	1.81	2.25	1.87	1.60	1.94	1.32	1.54	1.55	1.283
8	1.42	1.52	1.94	1.54	1.48	1.90	1.66	1.81	2.43	2.78	2.65	2.25	2.15	1.90	2.27	1.58	1.743
9	1.55	1.63	2.04	1.64	1.79	1.85	1.85	2.17	2.81	3.14	3.17	2.40	2.43	1.78	2.38	1.81	1.956
10	1.63	1.73	1.64	1.70	1.94	1.64	1.87	2.44	2.38	3.28	2.84	2.72	2.76	1.57	2.59	1.84	1.866
11	1.96	2.03	2.82	2.26	2.18	2.98	2.46	2.94	3.35	3.08	3.76	2.88	3.08	2.52	2.72	2.10	2.585
12	1.71	1.74	2.95	2.07	2.72	2.86	2.12	4.06	4.01	3.03	4.88	2.91	3.46	2.26	2.55	2.57	2.223
13	2.26	2.27	2.59	3.24	3.15	3.02	4.04	5.78	2.77	4.32	3.37	4.85	4.15	2.32	3.64	2.87	3.081
14	10.72	0.00	2.93	5.33	0.00	3.04	6.97	13.85	3.06	8.10	3.52	10.71	0.00	2.87	5.64	0.00	4.409
15	0.00	0.00	16.12	0.00	0.00	12.47	14.50	4.76	12.31	14.16	13.88	14.44	4.76	0.00	0.00	0.00	15.363
16	9.79	9.79	11.50	0.00	0.00	13.56	13.85	14.50	12.31	13.85	13.52	0.00	17.23	0.00	0.00	0.00	13.531

Notes: Gears: OTB-C = Canadian trawlers, OTB-F = French trawlers, SNU = seiners, GNS = gillnets, LLS = longlines, LHP = handlines

Quarters: 1 = Jan.-Mar., 2 = Apr.-June, 3 = July-Sept., 4 = Oct.-Dec.

Table 9. 4T-Vn cod catch at age ('000) for the period 1971-1986

CATCH AT AGE 2/ 9/87

I	71	72	73	74	75	76	77	78	79	80	81	82	83
3 I	6	3177	1337	2731	1556	466	546	538	142	314	96	372	33
4 I	2040	22152	6888	4980	8781	3460	3357	9854	4959	2019	3762	1244	1073
5 I	7082	11824	14327	4774	6761	8930	4115	10627	15531	15000	7277	10101	6031
6 I	9018	6541	5242	9404	2487	6563	2865	4463	10956	14152	18841	9530	11662
7 I	5746	7422	3648	2986	3237	1592	1686	2589	3391	9541	12863	12737	11328
8 I	2276	3467	2736	1795	1293	1138	406	1065	1670	1274	6026	6690	7223
9 I	1225	919	1803	1702	1104	446	291	237	835	699	867	2157	5067
10 I	510	529	540	1035	791	265	180	241	291	320	432	326	2478
11 I	129	354	328	266	671	135	124	104	247	124	190	110	105
12 I	346	114	97	194	150	140	55	72	64	24	64	58	40
13 I	73	49	67	85	53	45	59	44	33	16	81	6	15
14 I	117	14	46	26	74	14	11	5	15	8	2	3	7
15 I	151	46	11	6	7	10	4	13	15	11	14	2	4
16 I	61	36	23	15	66	9	5	6	8	26	3	2	2
3+I	28780	56644	37093	29999	27031	23213	13704	29858	38157	43528	50518	43338	45068

I	84	85	86
3 I	25	170	129
4 I	1198	1535	3400
5 I	3899	10217	7639
6 I	7040	17087	21623
7 I	8828	8288	9280
8 I	6736	6047	3697
9 I	5062	3964	2718
10 I	2871	2245	2191
11 I	931	955	1067
12 I	154	348	753
13 I	52	22	159
14 I	7	7	17
15 I	5	8	3
16 I	8	4	2
3+I	36816	50897	52678

Table 10. 4T-Vn cod average weight at age (kg) for the period 1971-1986

WEIGHT AT AGE 2/ 9/87

I	71	72	73	74	75	76	77	78	79	80	81	82
3 I	.760	.352	.456	.601	.481	.649	.533	.400	.505	.564	.503	.713
4 I	.815	.560	.667	.778	.737	.745	.758	.681	.706	.688	.674	.756
5 I	1.115	.916	.920	1.078	1.142	1.071	1.249	1.030	1.004	.919	.848	.971
6 I	1.402	1.331	1.274	1.485	1.763	1.505	1.809	1.661	1.414	1.206	1.132	1.179
7 I	2.146	1.516	1.683	1.959	2.363	2.170	2.437	2.261	2.213	1.472	1.382	1.448
8 I	3.681	2.542	2.301	2.677	2.752	2.835	3.513	2.815	3.299	2.643	1.832	1.670
9 I	3.836	4.922	3.574	2.893	3.221	3.220	4.242	4.354	4.064	2.895	3.150	2.111
10 I	5.253	5.929	5.507	4.176	3.699	3.867	4.290	4.657	7.134	3.566	4.122	3.077
11 I	6.010	7.117	6.004	6.065	4.457	4.750	5.074	6.495	7.021	7.958	4.456	3.847
12 I	4.775	8.051	7.904	7.260	6.961	5.058	5.492	6.551	6.701	5.805	5.603	3.712
13 I	6.821	8.830	6.150	8.290	9.202	6.238	6.743	6.250	4.698	10.316	6.032	6.380
14 I	7.457	10.124	6.707	6.600	6.319	10.343	8.977	5.090	8.713	5.813	7.080	9.287
15 I	7.914	5.599	8.918	9.122	8.390	11.472	10.795	11.566	15.415	9.770	3.490	4.180
16 I	17.897	11.185	6.047	11.748	6.175	14.301	9.258	10.195	17.396	9.355	6.760	11.100

I	83	84	85	86
3 I	.324	.448	.445	.437
4 I	.612	.655	.575	.602
5 I	.884	.786	.760	.816
6 I	1.138	1.082	.988	1.014
7 I	1.296	1.369	1.418	1.283
8 I	1.557	1.613	1.664	1.743
9 I	1.717	2.058	1.820	1.956
10 I	1.946	2.266	2.121	1.866
11 I	4.947	3.043	2.377	2.585
12 I	7.462	4.880	2.808	2.223
13 I	8.465	5.653	8.442	3.081
14 I	11.358	8.619	5.839	4.409
15 I	12.820	11.736	11.405	15.363
16 I	14.760	12.808	13.548	13.531

Table 11: ANOVA and coefficient estimates from the otter trawl catch rate standardization.

MULTIPLE R..... .880
MULTIPLE R SQUARED..... .774

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	8.581E0002	8.581E0002	
REGRESSION	48	7.103E0002	1.480E0001	76.703
TYPE 1	16	1.329E0002	8.369E0000	43.376
TYPE 2	1	1.818E0000	1.818E0000	9.424
TYPE 3	11	6.107E0001	5.552E0000	28.777
TYPE 4	20	3.746E0001	1.873E0000	9.709
RESIDUALS	1076	2.076E0002	1.929E-001	
TOTAL	1125	1.776E0003		

REGRESSION COEFFICIENTS

CATEGORY	CODE	VARIABLE	COEFFICIENT	STD. ERROR	NO. OBS.
1	2114	INTERCEPT	-0.098	0.102	1125
2	44				
3	1				
4	66				
1	2112	1	-1.282	0.064	92
	2113	2	-0.916	0.060	117
	2123	3	-0.756	0.094	60
	2124	4	-0.205	0.067	82
	2125	5	0.172	0.068	88
	3114	6	-0.077	0.065	97
	3125	7	0.191	0.073	76
	27113	8	-0.486	0.121	62
	27114	9	-0.009	0.121	50
	27122	10	-0.184	0.143	29
	27123	11	-0.105	0.119	79
	27124	12	-0.156	0.132	53
	27125	13	0.253	0.132	38
	28112	14	-1.026	0.121	52
	28113	15	-0.727	0.120	56
	28123	16	-0.651	0.129	48
2	43	17	0.151	0.049	804
3	2	18	0.043	0.058	114
	3	19	-0.472	0.070	74
	4	20	-0.350	0.054	161
	5	21	-0.794	0.064	122
	6	22	-0.880	0.072	86
	7	23	-0.816	0.079	60
	8	24	-1.016	0.081	55
	9	25	-1.047	0.078	62
	10	26	-0.990	0.075	71
	11	27	-0.887	0.070	94
	12	28	-0.593	0.071	77
4	67	29	-0.009	0.114	37
	68	30	0.306	0.113	37
	69	31	0.208	0.106	55
	70	32	0.107	0.105	60
	71	33	-0.068	0.102	68
	72	34	0.072	0.103	65
	73	35	-0.157	0.105	57
	74	36	-0.332	0.103	63
	75	37	-0.313	0.107	54
	76	38	-0.443	0.107	54
	77	39	-0.060	0.114	40
	78	40	0.249	0.114	40
	79	41	0.315	0.129	67
	80	42	0.290	0.135	60
	81	43	0.354	0.136	55
	82	44	0.422	0.134	62
	83	45	0.581	0.135	67
	84	46	0.558	0.146	36
	85	47	0.505	0.133	66
	86	48	0.610	0.136	57

Table 12: Standardized catch rate for otter trawls.

PREDICTED CATCH RATE

STANDARDS USED VARIABLE NUMBERS: 2114 43 9

YEAR	TOTAL CATCH	PROP.	CATCH RATE MEAN	S.E.	EFFORT
66	54851	0.194	0.405	0.046	135371
67	41316	0.322	0.402	0.039	102690
68	46551	0.389	0.551	0.054	84500
69	47819	0.462	0.500	0.046	95631
70	64465	0.355	0.452	0.042	142695
71	56375	0.427	0.372	0.033	151497
72	65291	0.458	0.436	0.038	149622
73	50634	0.339	0.347	0.032	145820
74	48747	0.310	0.291	0.026	167284
75	42471	0.355	0.297	0.027	142987
76	33415	0.504	0.318	0.030	104951
77	22219	0.428	0.382	0.038	58172
78	37892	0.439	0.520	0.052	72821
79	55996	0.470	0.554	0.070	101021
80	54634	0.399	0.540	0.071	101096
81	65177	0.350	0.576	0.077	113136
82	58193	0.372	0.617	0.081	94355
83	61295	0.396	0.722	0.096	84847
84	55364	0.202	0.705	0.102	78514
85	63047	0.396	0.670	0.087	94061
86	63441	0.307	0.744	0.099	85295

AVERAGE C.V. FOR THE MEAN: .109

Table 13 : ANOVA and coefficient estimates from seiner catch rate standardization.

MULTIPLE R..... .763
MULTIPLE R SQUARED..... .582

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	3.532E0002	3.532E0002	
REGRESSION	30	7.352E0001	2.451E0000	13.778
TYPE 1	3	1.401E0001	4.671E0000	26.261
TYPE 3	9	3.617E0001	3.908E0000	16.347
TYPE 4	18	2.287E0001	1.270E0000	7.142
RESIDUALS	297	5.283E0001	1.779E-001	
TOTAL	328	4.795E0002		

REGRESSION COEFFICIENTS

CATEGORY	CODE	VARIABLE	COEFFICIENT	STD. ERROR	NO. OBS.
1	2213	INTERCEPT	-2.454	0.163	328
3	9				
4	66				
1	2213	1	0.355	0.060	107
	2223	2	0.488	0.063	94
	27222	3	-0.245	0.161	9
3	1	4	0.690	0.227	4
	4	5	0.708	0.107	31
	5	6	0.439	0.100	36
	6	7	0.249	0.097	39
	7	8	0.042	0.095	42
	8	9	0.009	0.100	35
	10	10	0.185	0.099	36
	11	11	0.552	0.098	35
	12	12	0.876	0.107	29
4	67	13	0.647	0.211	8
	68	14	0.858	0.441	5
	69	15	0.906	0.192	13
	70	16	0.599	0.191	13
	71	17	0.558	0.187	15
	72	18	0.765	0.195	12
	73	19	0.608	0.177	24
	76	20	0.218	0.212	9
	77	21	0.617	0.183	18
	78	22	0.811	0.180	20
	79	23	0.988	0.174	27
	80	24	1.136	0.173	28
	81	25	1.147	0.173	29
	82	26	1.124	0.173	29
	83	27	1.093	0.173	29
	84	28	0.747	0.200	12
	85	29	0.721	0.186	16
	86	30	1.031	0.190	15

Table 14 : Standardized catch rates for seiners.

PREDICTED CATCH RATE

STANDARDS USED VARIABLE NUMBERS: 2212 9

YEAR	TOTAL CATCH	PROP.	CATCH RATE MEAN	S.E.	EFFORT
66	54851	0.040	0.093	0.015	591343
67	41316	0.043	0.177	0.029	233183
68	46551	0.012	0.217	0.044	214424
69	47819	0.014	0.230	0.031	207525
70	64465	0.015	0.169	0.023	380340
71	56375	0.021	0.163	0.021	346084
72	65291	0.018	0.200	0.028	326300
73	50634	0.018	0.171	0.020	295304
76	33415	0.014	0.115	0.019	289705
77	22219	0.092	0.173	0.021	128549
78	37892	0.082	0.210	0.025	180549
79	55996	0.121	0.251	0.029	223215
80	54634	0.159	0.291	0.032	187720
81	65177	0.158	0.294	0.032	221555
82	58193	0.167	0.290	0.032	200413
83	61295	0.188	0.279	0.030	219814
84	55364	0.078	0.196	0.029	282090
85	63047	0.106	0.192	0.025	328846
86	63441	0.111	0.261	0.035	243013

AVERAGE C.V. FOR THE MEAN: .134

Table 15: Research vessel survey mean numbers per tow at age (1971-1986)

4TVn COD RESEARCH VESSEL NUMBERS PER TOW AT AGE 8/ 9/87

	71	72	73	74	75	76	77	78	79	80
0	.00	.00	.02	.00	.00	.00	.01	.00	.14	.24
1	.06	.73	.07	.08	.40	2.99	.55	1.24	.17	.98
2	.57	2.07	4.69	2.31	5.42	7.33	10.19	5.11	21.67	4.61
3	6.18	4.54	9.30	10.10	4.08	31.73	15.12	23.12	22.00	31.99
4	7.48	12.13	4.31	7.08	6.18	7.98	12.75	24.91	46.65	24.03
5	7.10	5.02	6.86	2.74	5.18	5.34	4.99	14.08	28.46	41.83
6	5.52	4.18	3.23	3.31	1.82	2.25	2.65	4.28	11.60	20.53
7	3.49	2.85	2.29	1.43	1.30	.60	1.51	2.42	3.03	7.41
8	.85	1.65	1.73	1.01	.87	.44	.65	.83	1.24	1.23
9	.16	.31	1.09	1.01	.40	.25	.48	.33	.62	.60
10	.19	.23	.31	.44	.30	.23	.31	.41	.17	.25
11	.11	.20	.07	.18	.35	.21	.25	.48	.18	.06
12	.09	.06	.21	.09	.08	.06	.20	.06	.15	.01
13	.00	.03	.03	.19	.04	.06	.24	.00	.05	.01
14	.08	.02	.05	.00	.00	.02	.00	.13	.04	.05
15	.07	.03	.01	.04	.00	.00	.04	.03	.04	.01
16	.16	.04	.16	.11	.00	.02	.07	.00	.02	.01
0+	32.10	34.09	34.44	30.11	26.44	59.51	50.01	77.42	136.23	133.84
1+	32.10	34.09	34.42	30.11	26.44	59.51	50.00	77.42	136.10	133.60
2+	32.04	33.36	34.34	30.03	26.04	56.52	49.45	76.17	135.93	132.62
3+	31.47	31.29	29.65	27.72	20.62	49.19	39.26	71.06	114.26	128.02
4+	25.29	26.75	20.36	17.62	16.54	17.45	24.14	47.95	92.26	96.02
5+	17.82	14.62	16.04	10.54	10.36	9.48	11.39	23.04	45.61	72.00
6+	10.71	9.59	9.18	7.80	5.18	4.14	6.40	8.96	17.15	30.17

	81	82	83	84	85	86
0	.19	.21	.01	.00	1.30	1.20
1	4.72	3.04	5.94	2.18	3.93	6.54
2	20.50	25.17	19.66	11.06	12.65	17.68
3	19.03	16.10	42.39	15.06	33.09	36.10
4	56.76	20.63	36.50	33.86	43.45	46.50
5	47.03	23.94	19.46	42.10	78.66	49.60
6	45.89	38.14	14.04	15.67	88.85	57.75
7	19.31	19.67	12.16	8.09	21.13	41.47
8	10.40	9.35	8.36	8.54	8.32	12.07
9	1.38	2.89	3.98	3.41	5.93	2.28
10	.57	.32	2.62	1.56	3.06	3.18
11	.25	.12	.56	.54	2.00	.99
12	.10	.10	.11	.13	.68	.70
13	.06	.05	.32	.04	.03	.25
14	.05	.02	.04	.13	.00	.11
15	.06	.00	.06	.02	.00	.00
16	.08	.05	.00	.02	.07	.03
0+	226.39	159.80	166.20	142.42	303.16	276.45
1+	226.20	159.59	166.19	142.42	301.85	275.25
2+	221.48	156.54	160.25	140.24	297.93	268.71
3+	200.97	131.37	140.59	129.17	285.27	251.03
4+	181.94	115.27	98.20	114.11	252.18	214.93
5+	125.19	94.64	61.70	80.25	208.73	168.43
6+	78.16	70.70	42.24	38.15	130.07	118.82

Table 16 : Partial recruitment of otter trawls at Ft=0.4

OTTER TRAWL PARTIAL RECRUITMENT AT Ft .4 8/ 8/87

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
3	.000	.205	.058	.061	.074	.006	.005	.008	.005	.004	.003	.002	.000	.000	.002	.005
4	.115	.769	.677	.195	.507	.161	.131	.174	.128	.030	.081	.032	.015	.011	.022	.053
5	.744	1.000	1.000	.591	.638	.736	.817	.399	.643	.314	.218	.520	.197	.098	.129	.149
6	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	.516	.857	.657	.553	.420	.690	.387
7	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	.832	.931	1.000	.764	.785	.872	.671
8	.969	.760	.864	.598	.993	.730	.588	.903	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
9	.992	.405	.580	.796	1.000	.664	.443	.498	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
10	.609	.475	.424	.500	1.000	.497	.869	.611	.882	1.000	1.000	1.000	1.000	1.000	1.000	1.000
11	.683	.228	.632	.457	1.000	.478	.984	.623	.544	.609	1.000	1.000	.418	1.000	.539	.972
12	1.000	.366	.281	.630	.489	.455	.887	.484	1.000	.376	.589	1.000	.822	1.000	.974	1.000
13	1.000	.446	1.000	.297	.751	.434	1.000	.515	1.000	1.000	1.000	.819	.655	1.000	.487	.838
14	.553	.344	1.000	1.000	.954	.391	.205	.464	.385	.452	.451	.876	.453	.230	.994	.537
15	.896	.551	.099	.161	1.000	.378	1.000	.309	.228	.329	1.000	1.000	1.000	.385	1.000	1.000

Table 17: Calibration results using OTB CPUE and otter trawl fishable biomass. +/ RES is the sum of the last 5 residuals standardized to the mean squared error, squared

	Ft					
	.20	.25	.30	.35	.375	.40
r	.85	.86	.85	.84	.82	.80
a	-72911	-40899	-20149	-5326	603	5790
b	411	330	275	237	221	208
T	-2.02	-1.48	-.85	-.24	.03	.26
+/RES	10.09	8.93	7.51	6.35	5.93	5.63
R84	-1.09	-1.25	-1.33	-1.33	-1.31	-1.28
R85	1.08	.90	.66	.41	.30	.20
R86	2.19	1.73	1.15	.58	.32	.09

Table 18: Calibration results using 5+ RV mean numbers per tow and 5+ SPA mean numbers. +/RES is the sum of the last 5 residuals standardized to the mean squared error, squared

	Ft				
	.30	.35	.40	.425	.45
r	.88	.89	.900	.901	.901
a	97727	108198	116063	119304	122188
b	1098	849	662	585	517
T	3.33	5.11	7.42	8.74	10.06
+/RES	4.45	4.51	4.45	4.31	4.09
R84	.274	.117	-.111	-.253	-.410
R85	-.817	-.895	-.978	-1.007	-1.020
R86	1.881	1.875	1.852	1.781	1.662

Table 19: Results of linear regression analyses of mid-year SPA numbers at age 3 and 4 and research vessel mean numbers per tow at the corresponding ages and predicted size of these year-classes in 1986.

	Age 3	Age 4
r	0.78	0.71
a	32366	33715
b	1903	3499
Predicted size in 1986	160022 (1983 Year-class)	120887 (1982 Year-class)

Table 20: 4T-Vn (Jan-Apr) cod population numbers ('000) at Ft=0.4

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
3	87009	33737	45512	52031	41125	116539	171577	169193	126253	115444	85188	127525
4	38597	71232	24747	36076	40201	32303	95001	139981	138037	103239	94233	69659
5	30712	29755	38276	14152	25162	25200	23378	74743	105691	108528	82698	73748
6	30676	18737	13662	18629	7393	14661	12710	15417	51578	72479	75282	61123
7	18366	16956	9422	6536	6991	3868	6182	7814	8584	32315	46536	44586
8	5785	9854	7166	4479	2728	2880	1754	3536	4055	3960	17825	26461
9	3193	2677	4931	3440	2090	1098	1348	1069	1931	1809	2089	9141
10	1613	1506	1414	2436	1321	741	503	840	661	826	848	926
11	484	859	754	679	1085	387	372	249	470	278	386	304
12	547	279	383	326	323	300	197	192	110	161	115	144
13	144	135	125	228	97	132	121	112	92	32	110	36
14	289	52	66	43	111	33	68	46	52	46	12	17
15	390	131	30	13	13	26	14	46	33	29	30	8
3+	217824	185907	146487	139069	128639	198168	313227	413238	437546	439145	405353	413681
4+	130815	152171	100976	87038	87515	81629	141650	244045	311293	323701	320165	286155
5+	92218	80939	76229	50961	47314	49326	46649	104064	173257	220462	225932	216496
6+	61506	51184	37954	36809	22152	24126	23271	29321	67566	111934	143234	142748

	1983	1984	1985	1986
3	228406	193147	165321	176632
4	104072	186973	158113	135200
5	55907	84236	151997	128063
6	51240	40315	65439	115200
7	41420	31399	26637	38116
8	24981	23662	17720	14310
9	15611	13917	13278	9036
10	5532	8197	6814	7284
11	463	2287	4113	3547
12	149	284	1030	2503
13	66	86	93	529
14	24	40	23	57
15	11	14	27	13
3+	527882	584558	610605	630488
4+	299476	391411	445284	453856
5+	195404	204437	287171	318657
6+	139498	120201	135174	190594

Table 21: 4T-Vn (Jan-Apr) cod mean population biomass (t) at Ft=0.4

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
3	59932	10211	18519	27563	17574	68407	82745	61235	57752	58927	38813	82281
4	27697	29713	12645	23567	23671	20562	64026	83105	86620	63701	56328	47273
5	27020	18938	25101	11221	22202	19544	23884	64319	88396	83532	60520	60020
6	32445	18035	12313	17633	9593	14778	18206	19382	58256	70615	66337	59698
7	29356	17232	11187	8537	10954	5800	11543	12956	13226	35852	49143	49005
8	14846	18075	11682	8391	4929	5721	4859	7469	9179	7732	23822	34338
9	8609	9740	12645	6406	4191	2455	4557	3694	5288	3672	4503	15170
10	6287	6443	5520	6977	2814	2070	1551	2968	3151	2063	2185	2056
11	2236	4195	3064	2906	2720	1338	1381	1106	2026	1468	1096	836
12	1404	1547	2361	1370	1486	997	827	891	424	779	382	371
13	613	849	473	1348	546	604	523	487	311	210	301	205
14	1488	400	220	163	371	232	507	199	341	217	69	129
15	2173	530	188	80	63	210	119	406	338	199	69	26
3+	214107	135910	115919	116163	101114	142718	214727	258217	325308	328966	303568	351408
4+	154175	125699	97400	88600	83540	74311	131982	196983	267556	270039	264755	269126
5+	126478	95986	84755	65032	59868	53749	67956	113877	180936	206338	208427	221853
6+	99457	77047	59654	53811	37666	34205	44073	49558	92540	122806	147907	161833

	1983	1984	1985	1986
3	67068	78421	66641	69932
4	57409	110618	81972	72774
5	42155	58512	100889	91668
6	46104	35712	49946	94895
7	41105	32734	28132	38291
8	29447	28990	21456	19330
9	19760	20469	18169	13291
10	7150	13419	10614	10221
11	1813	4796	7706	6895
12	855	837	2111	4185
13	440	271	620	1225
14	209	285	102	187
15	104	113	229	147
3+	313617	385175	388587	423042
4+	246550	306755	321946	353110
5+	189141	196137	239973	280336
6+	146986	137625	139084	188668

Table 22: 4T-Vn (Jan-Apr) cod fishing mortality at Ft=0.4

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
3	.000	.110	.032	.058	.041	.004	.004	.004	.001	.003	.001	.003	.000	.000
4	.060	.421	.359	.160	.267	.123	.040	.081	.041	.022	.045	.020	.011	.007
5	.294	.578	.520	.449	.340	.484	.216	.171	.177	.166	.102	.164	.127	.053
6	.393	.487	.537	.780	.448	.664	.287	.386	.268	.243	.324	.189	.290	.214
7	.424	.661	.544	.674	.687	.591	.359	.456	.574	.395	.365	.379	.360	.372
8	.571	.492	.534	.562	.710	.559	.295	.405	.607	.439	.468	.328	.385	.376
9	.552	.438	.505	.757	.837	.580	.273	.281	.650	.557	.614	.302	.444	.514
10	.430	.492	.533	.609	1.028	.490	.503	.381	.667	.559	.827	.493	.683	.490
11	.349	.608	.639	.544	1.087	.473	.460	.618	.870	.681	.784	.511	.288	.598
12	1.202	.600	.320	1.015	.693	.704	.368	.535	1.030	.180	.954	.586	.352	.913
13	.824	.515	.872	.516	.874	.459	.771	.571	.504	.798	1.669	.202	.290	1.106
14	.593	.357	1.408	1.031	1.254	.631	.196	.128	.386	.216	.206	.217	.384	.213
15	.550	.486	.523	.685	.933	.546	.364	.371	.683	.541	.709	.326	.495	.518
9+	.568	.488	.528	.692	.942	.548	.372	.378	.689	.547	.725	.328	.500	.520

	1985	1986
3	.001	.001
4	.011	.028
5	.077	.068
6	.340	.231
7	.421	.311
8	.473	.333
9	.400	.400
10	.453	.400
11	.297	.400
12	.467	.400
13	.302	.400
14	.404	.400
15	.399	.400
9+	.400	.400

Table 23: Input parameters used for projections.

Age	1987 Population Numbers ('000)	Weights at age (kg)	Partial recruitment
3	96,000	0.443	0.0021
4	144,497	0.611	0.070
5	107,622	0.787	0.170
6	97,956	1.028	0.578
7	74,860	1.357	0.777
8	22,867	1.673	0.833
9	8,394	1.945	1.000
10	4,959	2.084	1.000
11	3,998	2.668	1.000
12	1,947	3.304	1.000
13	1,374	5.725	1.000
14	290	6.289	1.000
15	31	12.835	1.000

Table 24: 4TVn (Jan-Apr) cod projections for 1988 assuming a 1987 catch of 45,200 t and fishing at F0.1 (0.2) in 1988.

Age	Population Numbers ('000)	Catch Biomass (t)	Population Biomass (t)	Fishing mortality
3	96,000	16	38,567	0.000
4	78,563	607	43,189	0.014
5	116,479	2,780	81,768	0.034
6	84,863	8,643	74,816	0.116
7	70,584	12,529	80,589	0.155
8	51,611	12,051	72,300	0.167
9	15,571	4,992	24,958	0.200
10	5,509	1,893	9,465	0.200
11	3,255	1,432	7,158	0.200
12	2,624	1,429	7,144	0.200
13	1,278	1,206	6,029	0.200
14	902	935	4,674	0.200
15	190	403	2,014	0.200

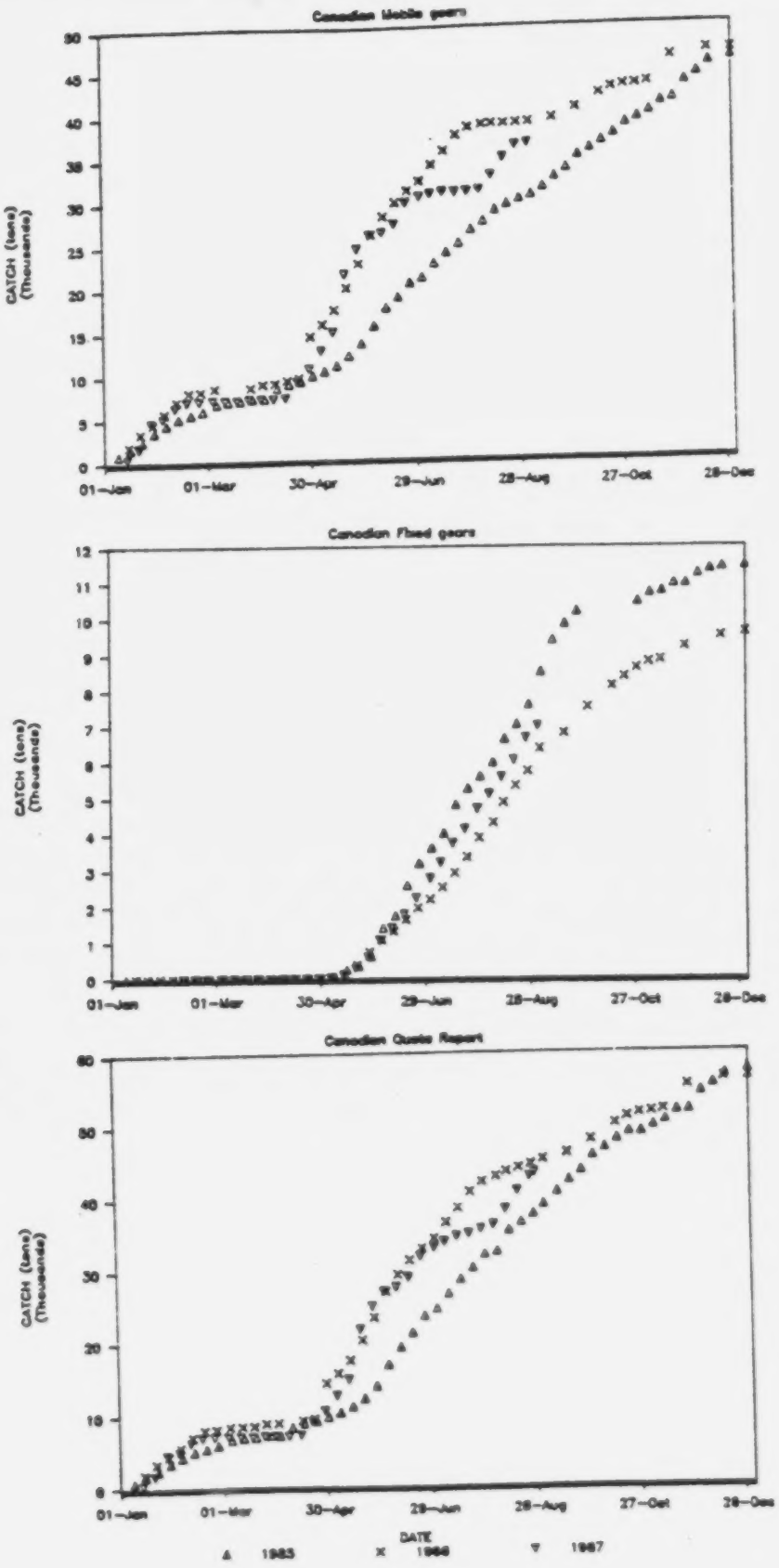


Figure 1 : Cumulative landings of cod in 4TVn(1985-1987- to date)
(Source: Canadian Atlantic Quota Report , DFO)

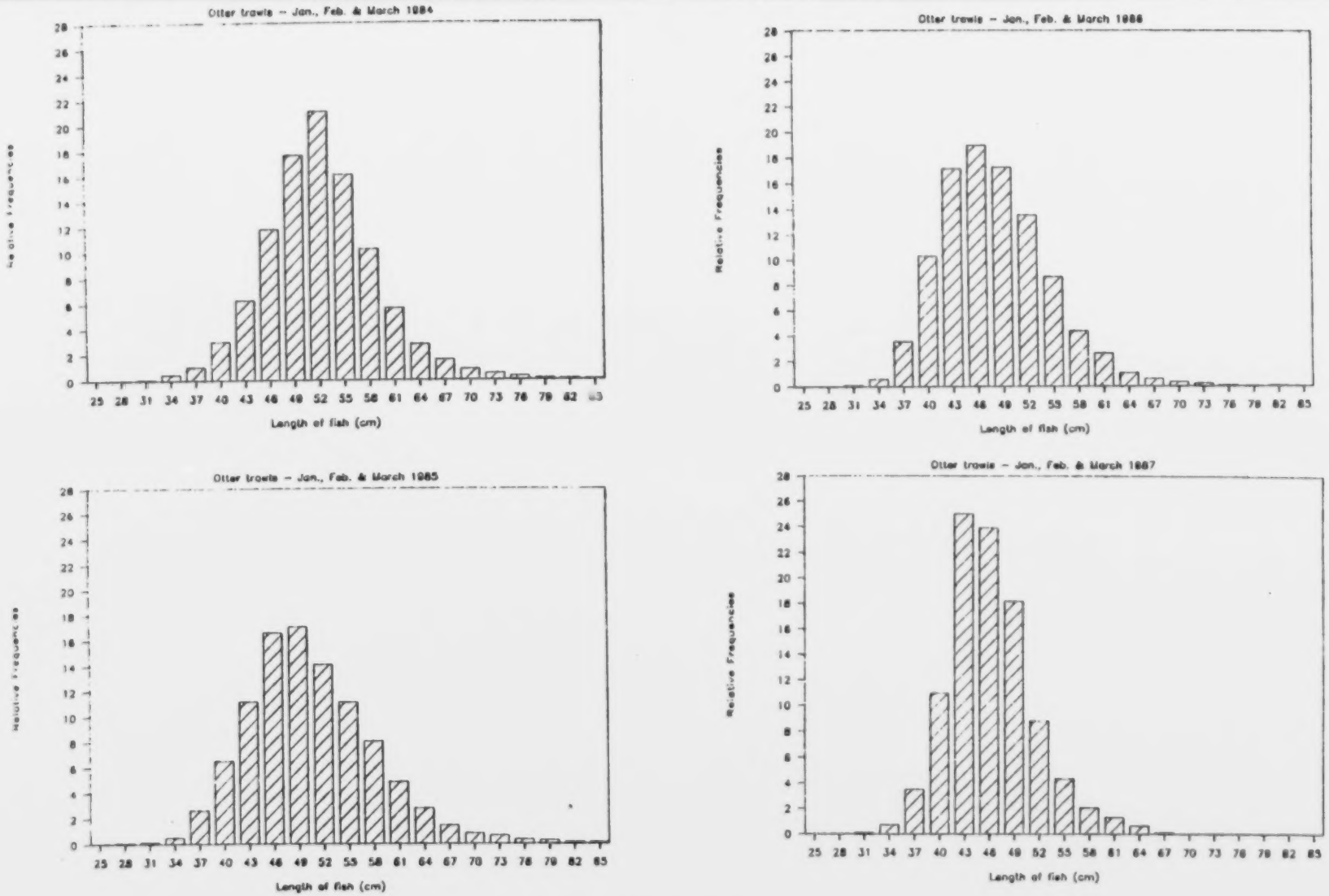

Otter trawls – Jan., Feb. & March 1984
Otter trawls – Jan., Feb. & March 1986
Otter trawls – Jan., Feb. & March 1985
Otter trawls – Jan., Feb. & March 1987
Relative Frequencies
Length of fish (cm)
25 28 31 34 37 40 43 46 49 52 55 58 61 64 67 70 73 76 79 82 85

Figure 2 : Relative length frequencies of cod in otter trawler catches in the first quarter (1984-1987)

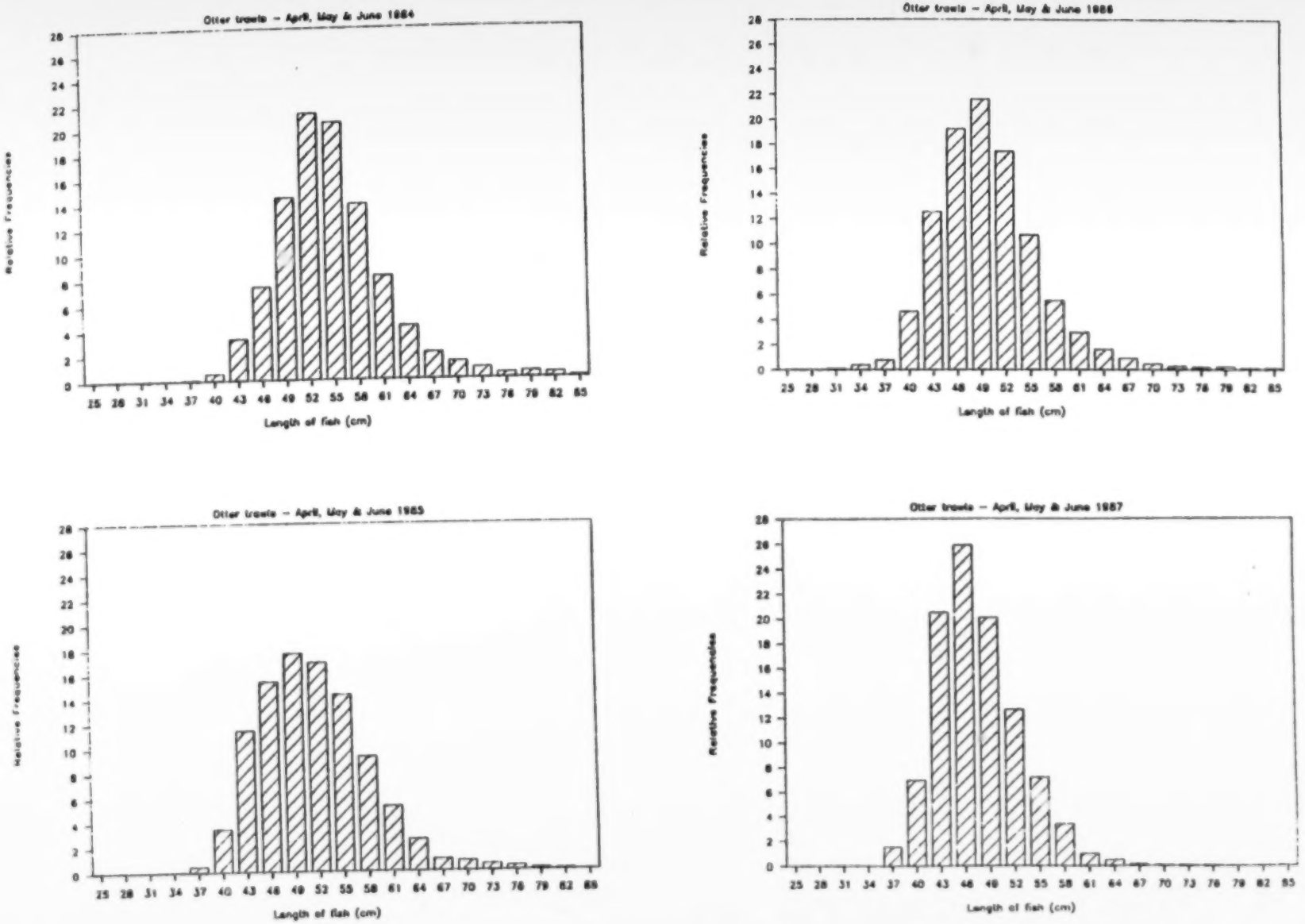

Otter trawls – April, May & June 1984
Otter trawls – April, May & June 1986
Otter trawls – April, May & June 1985
Otter trawls – April, May & June 1987
Relative Frequencies
Length of fish (cm)
25 28 31 34 37 40 43 46 49 52 55 58 61 64 67 70 73 76 79 82 85

Figure 3 : Relative length frequencies of cod in otter trawler catches in the second quarter (1984-1987)

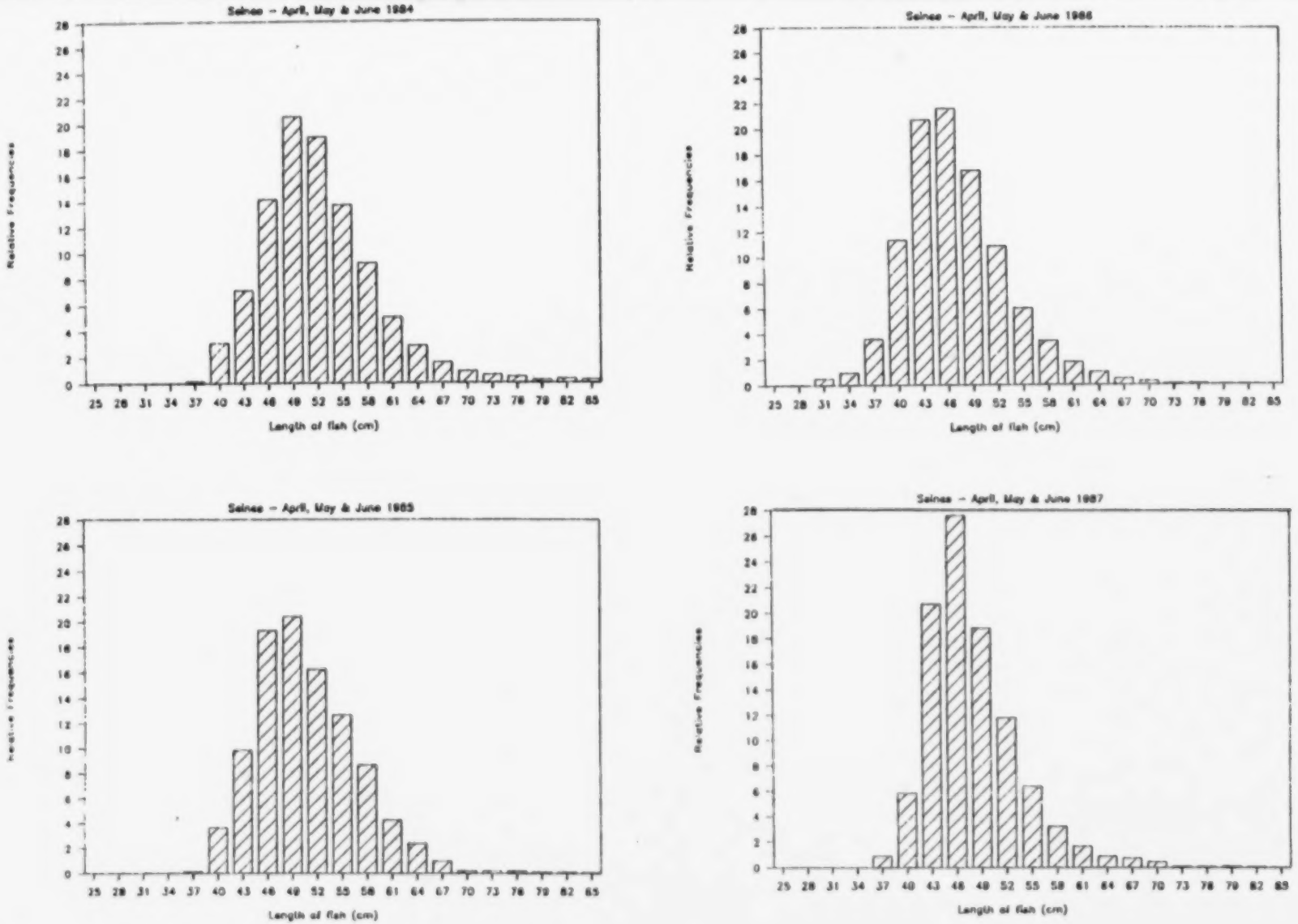

Seines - April, May & June 1984
Seines - April, May & June 1986
Seines - April, May & June 1985
Seines - April, May & June 1987
Relative Frequencies
Length of fish (cm)
25 28 31 34 37 40 43 46 49 52 55 58 61 64 67 70 73 76 79 82 85

Figure 4 : Relative length frequencies of cod in seine catches in the second quarter (1984-1987)

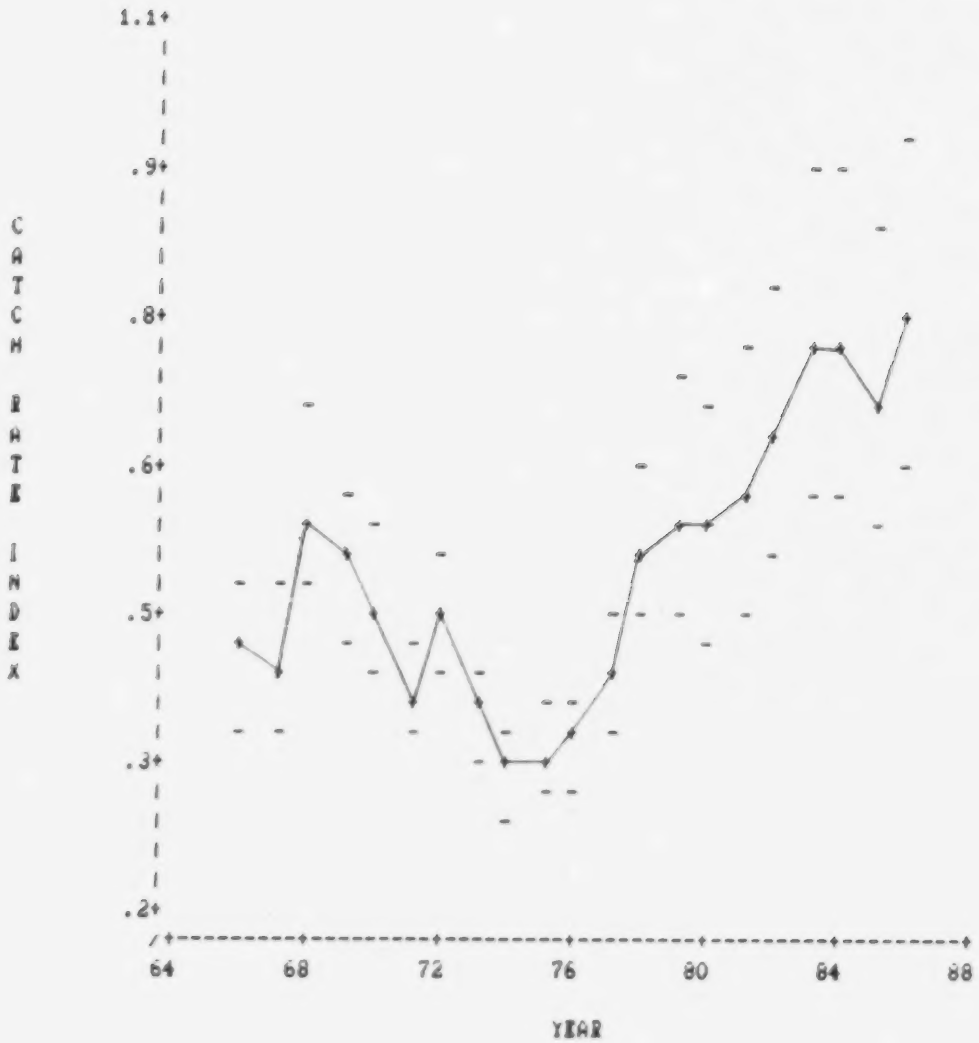


Figure 5: Standardized otter trawl catch rate with 1984 Can(Q) data removed.

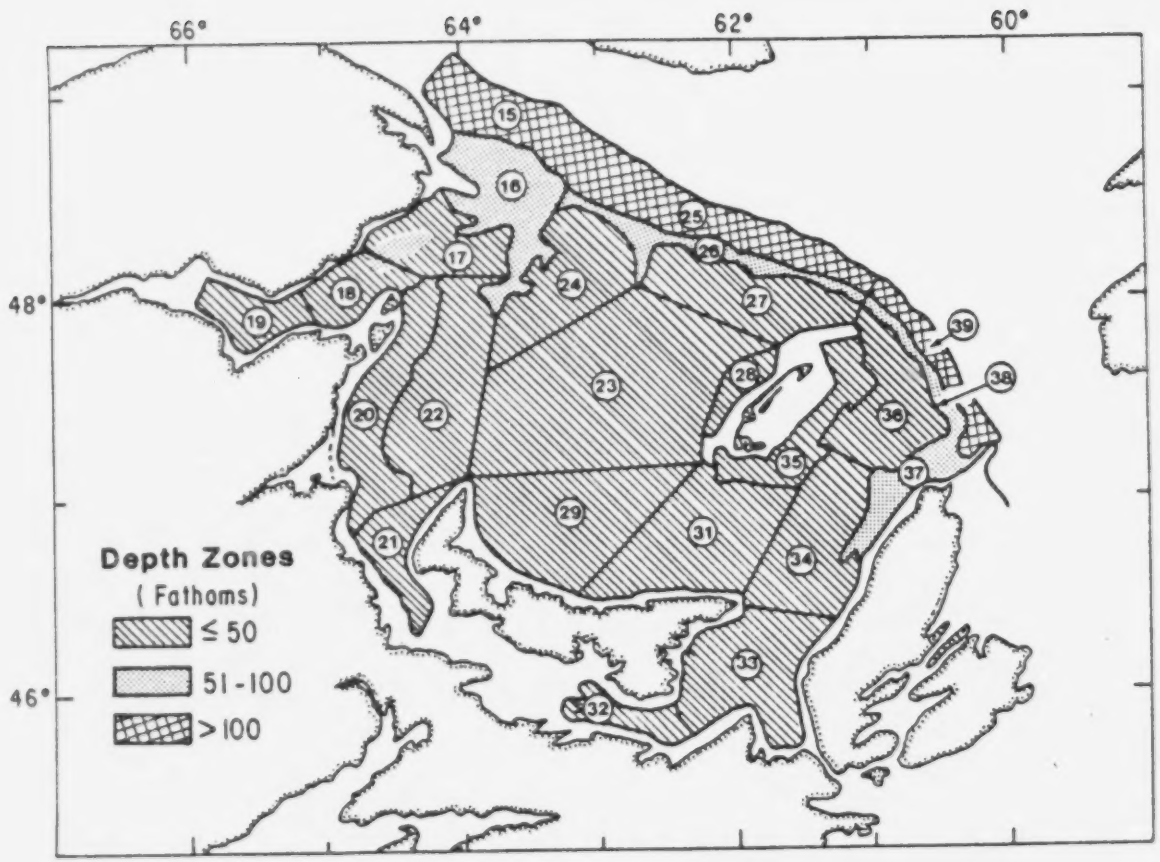


Figure 6 : Stratification scheme for the southern Gulf of St Lawrence research surveys

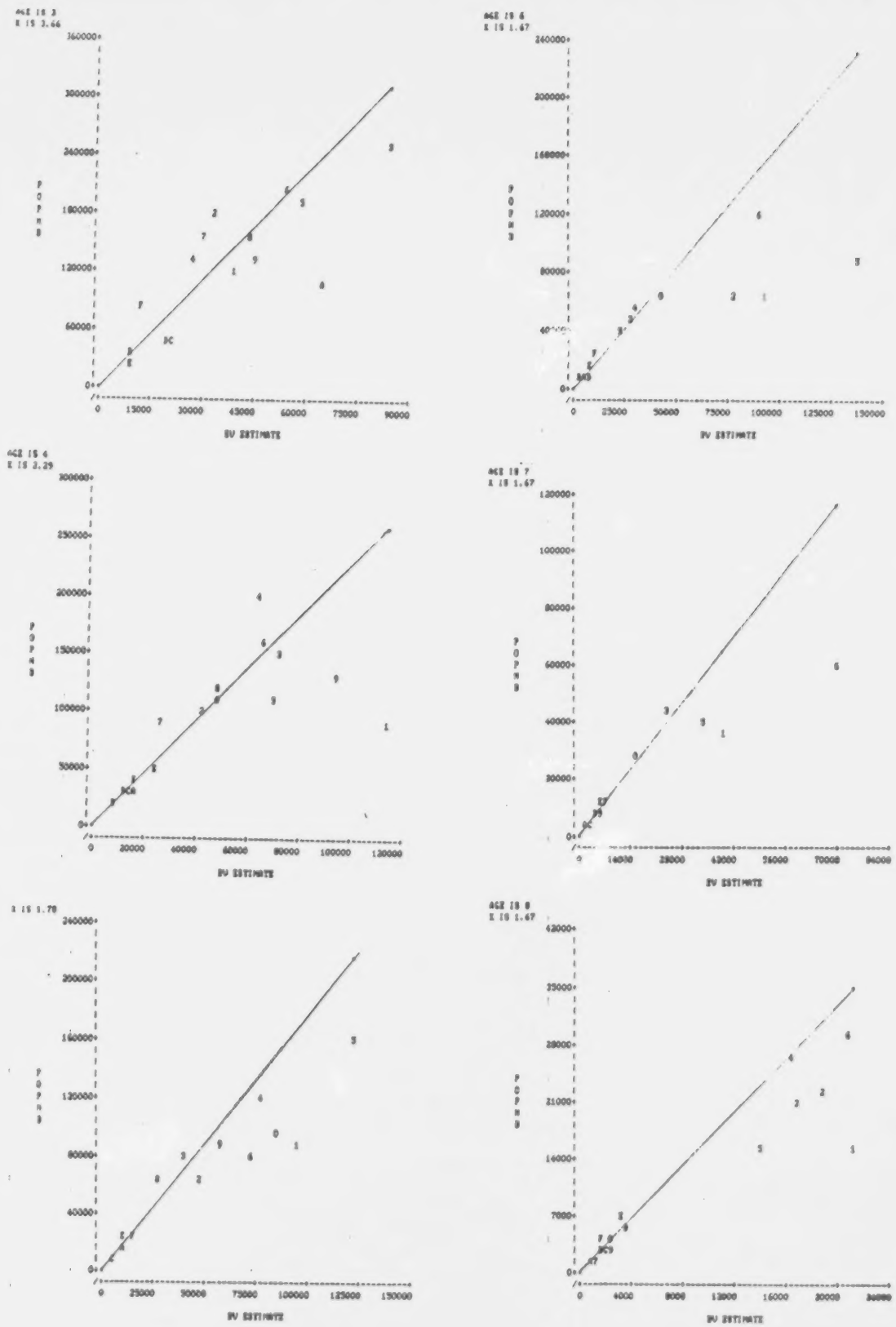
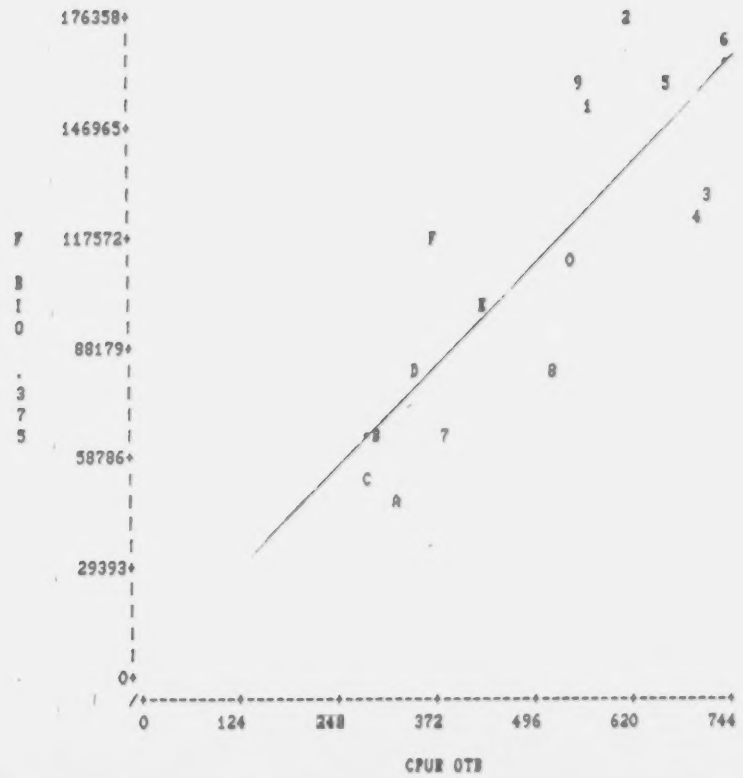
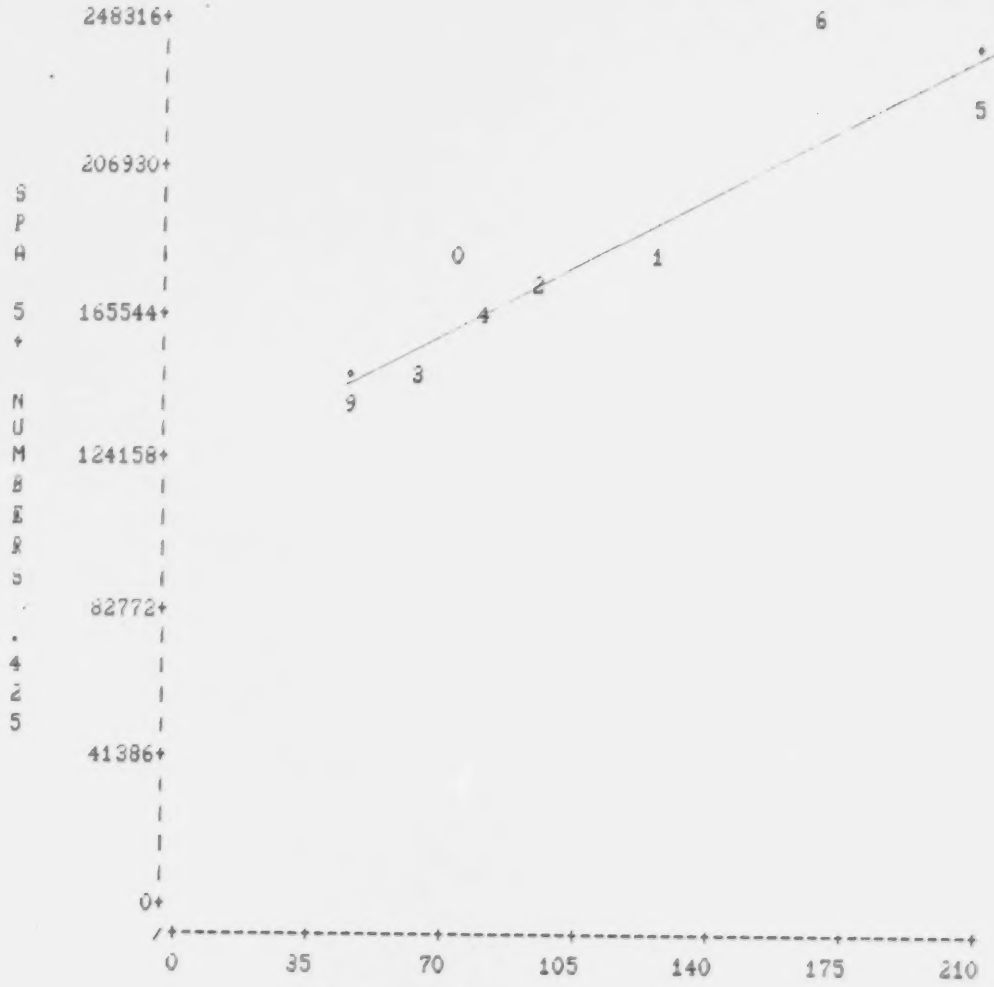


Figure 7 : Plots of population numbers vs RV estimates from a Survivor analysis of 1971-86 data. Point labels are given in Figure 8 .



S	YEAR	RESIDUALS	IND	DEP
F	71	1.380	372	118176
E	72	.203	436	102207
D	73	.155	347	81305
C	74	-.372	291	55435
B	75	-.083	297	64152
A	76	-.936	318	46985
7	77	-.705	382	67054
8	78	-1.200	520	84911
9	79	1.412	554	159230
0	80	-.401	540	109768
1	81	.994	576	153429
2	82	1.536	617	176352
3	83	-1.293	722	127197
4	84	-1.307	705	123076
5	85	.298	670	136406
6	86	.319	744	173304

Figure 8 : Calibration plot of otter trawl CPUE vs otter trawl fishable biomass at F_t of .375.



S	YEAR	RESIDUALS	IND	DEP
9	79	-.371	46	139649
0	80	.968	72	177984
1	81	-.781	125	179205
2	82	-.109	95	172816
3	83	-.227	62	151533
4	84	-.253	80	161942
5	85	-1.007	209	224225
6	86	1.781	168	248314

SSQ LAST 5 STAND RES 4.314629457

Figure 9: Calibration plot of RV mean number per tow (5+) vs SPA mean numbers at Ft=0.425

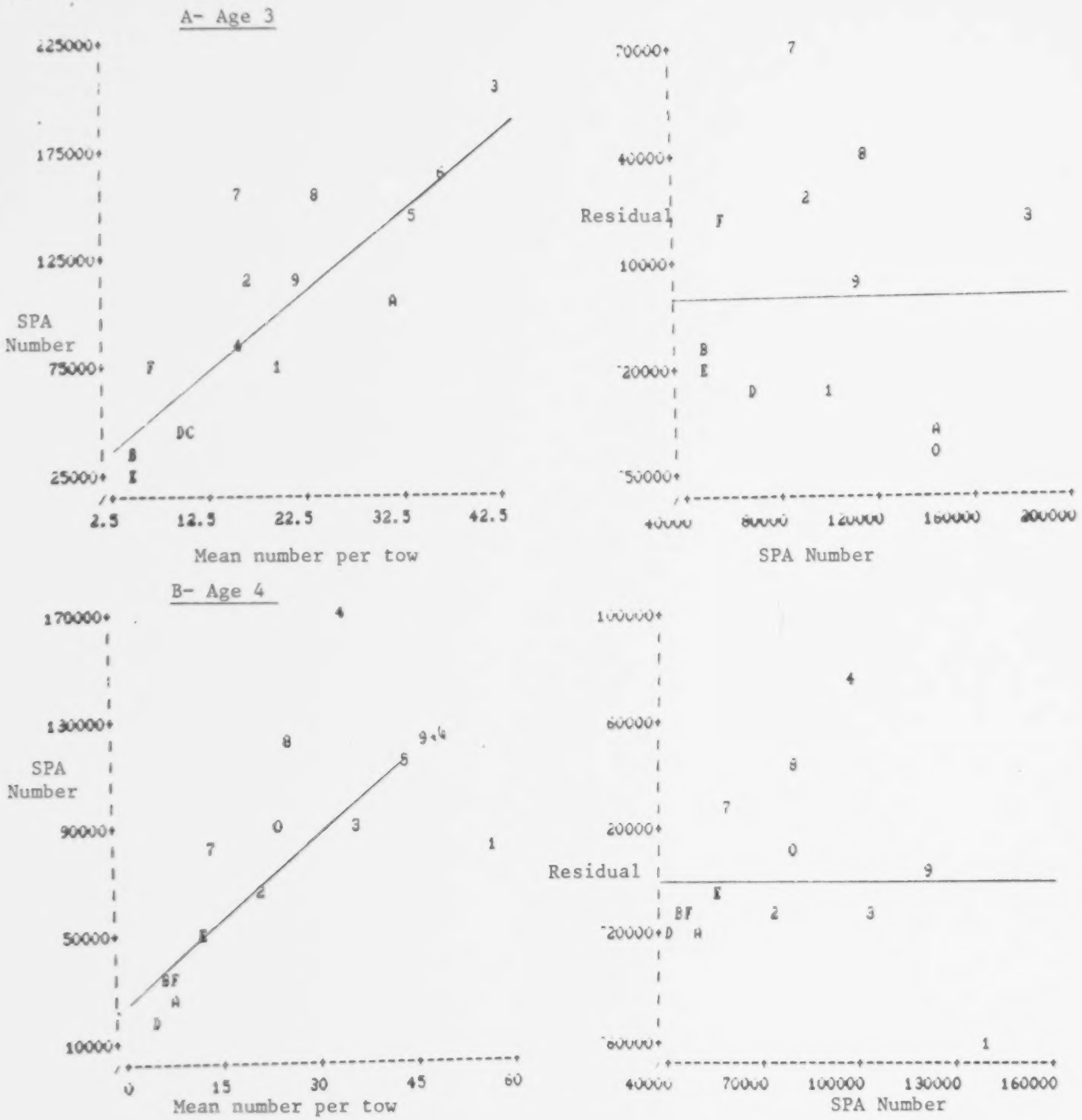


Figure 10: Relationship and plot of the residuals for the regressions between SPA numbers and RV mean number per tow. A- Age 3, B- Age 4
Year labels are as follows: 1971- A 1979- 9
1972- B 1980- 0
1973- C 1981- 1
1974- D 1982- 2
1975- E 1983- 3
1976- F 1984- 4
1977- 7 1985- 5
1978- 8 1986- 6

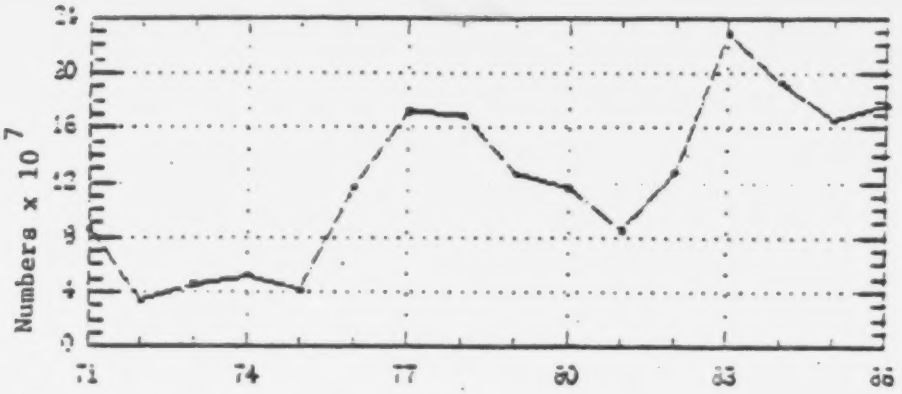


Figure 11: 4T-Vn (Jan-Apr) cod age 3 numbers for the period 1971-1986

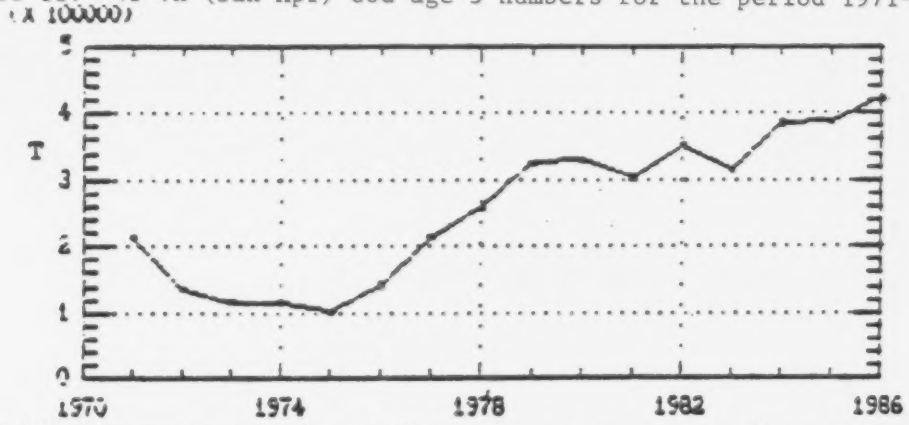


Figure 12: 4T-Vn (Jan-Apr) cod 3+ mid-year biomass for the period 1971-1986

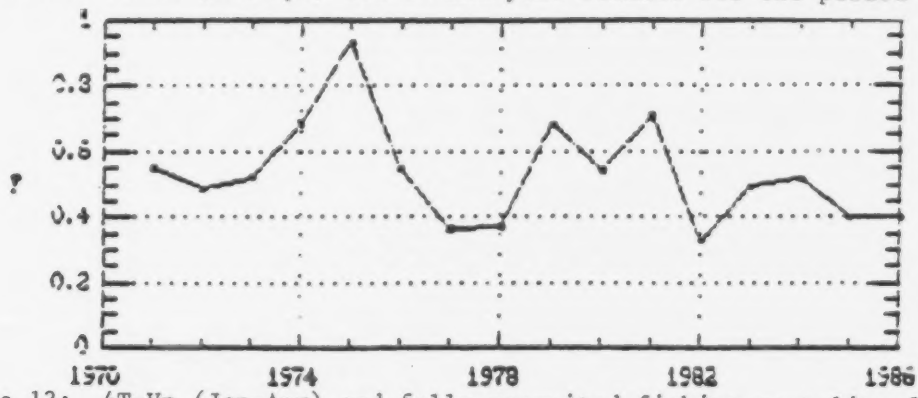


Figure 13: 4T-Vn (Jan-Apr) cod fully recruited fishing mortality for the period 1971-1986

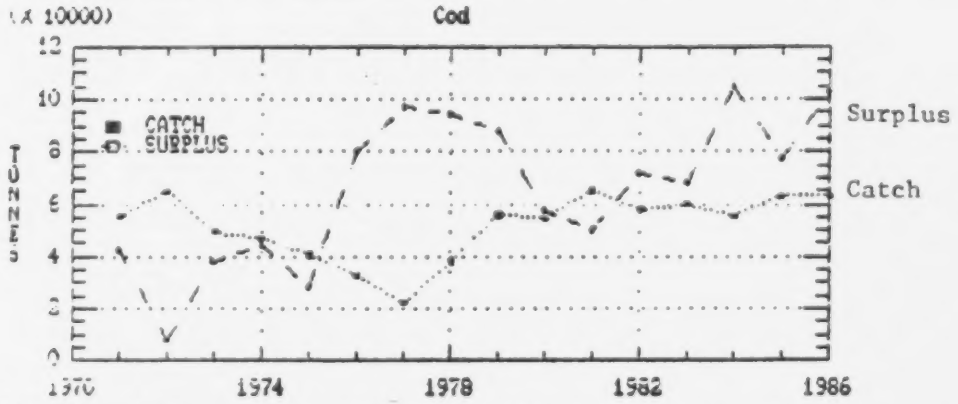


Figure 14: Surplus production for 4T-Vn (Jan-Apr) cod for the period 1971-1986

Appendix I : Final 4T cod catches (t round weight) during 1984 by gear type and month in Maritime Provinces and Quebec.

MARITIMES

GEAR	MONTH J	F	M	A	M	J	J	A	S	O	N	D	TOTAL	% OF 4TVn (Jan-Apr) CATCH
Otter trawl					485	143	130	173	122	442	246	10	1751	3.16
Otter trawl (side)	137			158	809	184	70	13	13	50	91	19	1544	2.79
Otter trawl (stern)	2063	105	44	180	440	286	153	80	63	358	768	1024	5564	10.05
Midwater trawl (side)							4		8				12	0.02
Danish seine				1641	3128	743	394	318	216	615	1428	1299	9782	17.67
Scottish seine					502	152				4	44	22	724	1.31
Set gillnet				81	288	392	760	880	548	345	237	21	3552	6.42
Set lines				9	21	61	50	65	45	192	574	343	1360	2.46
Handlines					26	99	119	92	53	66	49	3	507	0.92
Uncov. pound nets					11	17	9	6	3	13			59	0.11
Other gears										3			3	0.01
Total	2200	105	44	2069	5710	2077	1689	1627	1071	2088	3437	2741	24858	44.90

QUEBEC

Otter trawl					2	5	10	3	21	44	4		89	0.16
Otter trawl (side)				41	2263	997	604	513	620	1041	168		6247	11.28
Otter trawl (stern)				1	340	258	210	339	318	321	88	11	1886	3.41
Danish seine						14	7	6	11				38	0.07
Scottish seine									2	3			5	0.01
Set gillnet				24	807	913	630	605	280	80			3339	6.03
Set lines				4	268	192	584	467	339	341	38		2233	4.03
Handlines				3	24	197	254	399	268	190	19	1	1355	2.45
Uncov. pound nets					1								1	0.00
Not known					75	209	254	30	30	3			601	1.09
Total	0	0	0	73	3780	2785	2553	2362	1889	2023	317	12	15794	28.53
Total 4T	2200	105	44	2142	9490	4862	4242	3989	2960	4111	3754	2753	40652	73.43

Appendix II : Final 4Vn (Jan-Apr) cod catches (t round weight) during 1984 by gear type and month in Maritime Provinces, Newfoundland and France.

MARITIMES

GEAR TYPE	MONTH J	F	M	A	TOTAL	% OF 4TVn (Jan-Apr) CATCH
Otter trawl (side)	1638	1478	473	243	3832	6.92
Otter trawl (stern)	1235	626	387	460	2708	4.89
Danish seine				19	19	0.03
Scottish seine				48	48	0.09
Set lines	77		1	67	145	0.26
TOTAL	2950	2104	861	837	6752	12.20

NEWFOUNDLAND

Otter trawl (side)		175	351	320	846	1.53
Otter trawl (stern)	137			507	644	1.16
TOTAL	137	175	351	827	1490	2.69

FRANCE

Otter trawl (stern)	4340	1508	622		6470	11.69
TOTAL	4340	1508	622		6470	11.69
TOTAL 4Vn	7427	3787	1834	1664	14712	26.57

Appendix III : Provisional 4T cod catches (t round weight) during 1985 by gear type and month in Maritime Provinces, Newfoundland and Quebec.

MARITIMES

GEAR	MONTH J	F	M	A	M	J	J	A	S	O	N	D	TOTAL	% OF 4TVn (Jan-Apr) CATCH
Otter trawl (side)		33			606	500	193	13	454	516	782		3097	4.91
Otter trawl (stern)	226			289	649	184	345	313	633	237	505	1496	4877	7.74
Shrimp trawl					28	58	25		32	28			171	0.27
Danish seine				475	3085	1914	1055	759	720	762	2201	1130	12101	19.19
Scottish seine					12								12	0.02
Pair seine					7	1	8	11	6	7	23	15	78	0.12
Gillnets (set)	1			2	165	137	568	430	332	243	60		1938	3.07
Drift gillnet				6	16	10	11			1			44	0.07
Set lines					2	38	88	73	90	57	447	91	886	1.41
Handlines						5	46	68	82	33	19		253	0.40
Baited handlines					4	88	71	134	114	79	12	1	503	0.80
Uncov. pound nets	1				23	13	33	24	22	5			121	0.19
TOTAL	228	33	0	772	4597	2948	2443	1825	2485	1968	4049	2733	24081	38.19

NEWFOUNDLAND

Otter trawl (stern)	43	35	19	1072									1169	1.85
TOTAL	43	35	19	1072									1169	1.85

QUEBEC

Otter trawl				1	20	8		81	181	64	17		372	0.59
Otter trawl (side)				203	1787	2391	3120	1547	1856	1422	426		12752	20.23
Otter trawl (stern)				203	312	417	625	420	461	425	139		3002	4.76
Bottom pair trawl							22	109	66	29	26		252	0.40
Danish seine						17	7	2	2		28		56	0.09
Set gillnet				98	1055	758	589	594	172	51	4	1	3322	5.27
Set lines				23	138	377	401	567	514	295	7		2322	3.68
Handlines				3	49	203	339	283	285	127	14	1	1304	2.07
Traps (not spec.)						2	1						3	0.00
Uncov. pound nets						10				1			11	0.02
Miscellaneous						2							2	0.00
TOTAL	0	0	0	531	3361	4185	5104	3603	3537	2414	661	2	23398	37.11
TOTAL 4T	271	68	19	2375	7958	7133	7547	5428	6022	4382	4710	2735	48648	77.16

Appendix IV : Provisional 4Vn (Jan.-Apr.) cod catches (t round weight) during 1985 by gear type and month for Maritime Provinces, Newfoundland and France .

Maritimes

GEAR TYPE	J	F	MONTH M	A	TOTAL	% OF 4TVn (Jan-Apr) CATCH
Otter trawl (side)	951	837	543	229	2560	4.06
Otter trawl (stern)	1392	889	168	161	2610	4.14
Handlines				1	1	0.00
Set lines				1	1	0.00
TOTAL	2343	1726	711	392	5172	8.20
NEWFOUNDLAND						
Otter trawl (stern)	1091	932	375	67	2465	3.91
TOTAL	1091	932	375	67	2465	3.91
FRANCE						
Otter trawl (stern)	1877	4483		402	6762	10.73
Total	1877	4483		402	6762	10.73
TOTAL 4Vn	5311	7141	1086	861	14399	22.84